Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. ROB'T MCKEAN, Secy.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 31—Berlin N. W. 7.

WALTER RENTON INGALLS, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engmnjour, N. Y.

CIRCULATION STATEMENT

Of this issue 10,000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

Contents

PAGE

Editorials: ....
The American Iron and Steel Institute 819
Notes on Mineral Waste..... 819
Affairs in Mexico..... 820
Safety in Mining..... 820
Cyanide Practice..... 820
By the Way..... 821
Correspondence and Discussion:
Pacific Smelting & Mining Co.... Basic Copper Converting....The Situation in Mexico..... 822
Notes on Development of Mining Law.....H. C. and L. H. Hoover 823
American Institute of Mining Engineers 826
Lacroix Electrolytic Cell..... 827
Aluminum Foil and Powder..... 827
Number of Mines in the United States 827
Westralian 1911 Mineral Output.... 827
Iron and Steel Institute..... 828
Details of Practical Mining:
*Loading Cars from Three Track Approach....The Smoke Gravel Shaker....*Safety Catches for Rope Guides....*Shaft Timbering in Minnesota Iron Mines.... *Hanging Troughs for Protecting Trolley Wires....Compressed Air Meter....*Track Spreader and Guard Rail Bracket....Laying Up a Boiler....Neutralizing Blasting Fumes....Hammer Drills at Premier 829
Details of Metallurgical Practice:
*Automatic Filter Feed....*Hexagonal Trommel for Fine Pulp.... Method for Handling Tube Mill Pebbles....*Muffle Annealing Furnace....*Hanger for Light Pipe.. 833
Notes from Current Literature:
Thoria Recovery....Stage Charging in Openhearth Process....Hybinette Copper Extraction Process ....Erkens' Aluminum Solder.... Heavy Electrolytic Nickel Deposits....The St. Helens Mining District....Gold in the Texas Eocene Deposits....Nickel Extraction in Norway....Precipitation of Carbon in Copper Analysis.... Purification of Zinc Solutions.... Improved Mercury Cathode..... 835
*Cyanidation in the Cobalt District. Herbert A. Megraw 837
The Iron Ratio for Converter Cost Comparisons.....David H. Broune 842
South African 1911 Mineral Output.. 842
*Gadomsky's Copper Leaching Process 842
*The Ore Deposits of Goldfield—II. Augustus Locke 843
*Rapid Determination of Sulphur in Roasted Blende..... 849
Mining Index..... 850
Personal, Obituary and Societies.... 854
Editorial Correspondence..... 855
Mining News..... 857
Markets 863

*Illustrated

The Engineering and Mining Journal

Vol. 94 NOVEMBER 2, 1912 No. 18

The American Iron and Steel Institute

The meeting of the Iron & Steel Institute in Pittsburgh last week was the first one outside of the yearly meetings which have been so far devoted chiefly to business and conference; and it was the first one under the new program of the institute, which provides for a larger share of time and attention for the technical side. The meeting must be considered a successful one so far as the size and quality of the attendance is considered. It was the means of bringing together a large number of men prominent in the iron and steel industries, both on the business and technical sides. It was notable for the strict attention to business, and the postponement of all outside attractions until after the meeting was ended. The limitation of the sessions to one day, however, cut down the time allotted for discussion of the papers read to a brief space.

Several excellent technical papers were presented, but the business side had a prominent place also, the most notable paper being on "The Buyer from a Manufacturer's Standpoint," which attracted much attention and some discussion. The paper was a fair statement from the seller's side, but seemed to demand more consideration for that side than buyers are ever likely to give. A notable feature in the list of papers is that safety appliances and working conditions, to which the institute had promised to give much attention, were questions that were entirely omitted.

President Gary's address was an adroit one in its careful treatment or avoidance of political and economic questions which would be likely to stir up differences; while enough was said to show that he has not changed his mind as expressed in his former utterances on such points. Perhaps its omissions were more notable than its actual expressions.

Upon the whole it may be said that the institute made in this meeting a fair start upon its professional or technical course. It remains to be seen, however, how much of the purely technical element the institute will attract, and how far its activities in this direction will affect the Iron & Steel Division of the American Institute of Mining Engineers. It may take more of such meetings to remove the rather general impression that the Iron & Steel Institute is more a trade and financial than a technical association.

Notes on Mineral Waste

U. S. Bureau of Mines has recently published a bulletin on mineral waste, by Prof. Charles L. Parsons, late of New Hampshire College, who is a recent addition to the staff of the bureau. This bulletin draws renewed attention to our enormous waste of minerals, and their derivatives, in production and consumption. Professor Parsons' exposition, however, is refreshing in that he does not consider the producers to be the only wastrels, but blames the consumers quite as much, or even more, which is a view that we have previously taken.

But Professor Parsons does not by any means absolve the producers. His discussion of their operations displays in the main the possession of good information and a good deal of common sense, although references to details are open to criticism. Especially may some attention be directed to his remarks about the zinc industry. Zinc is the scapegoat of all the metals. In the eyes of the inexperienced, the zinc smelters of the world are an unscientific, backward lot of metallurgists, who stubbornly adhere to the methods of a century ago with but minor improvements in details, and year after year, suffer contentedly great losses of the metal of the ore that they treat. For our own part, we can say with some positiveness, that the zinc-smelting profession has not stood still and has succeeded in accomplishing a modern prac-

tice that is not so very discreditable, even in comparison with the practice in some other metals.

We have constructed a formula that we wish conservationists and general theorists would notice, and ever keep prominently before their eyes. Our formula is the following:

$$X = M - (O + C + 0.1P + 0.06P)$$

In the above formula M represents the value of the metal extractable from a ton of ore of given metallic contents; O is the cost of the ton of ore; C is the direct metallurgical operating cost per ton of ore, including administration and general expense, repairs and renewals of plant, and the cost of the use of money required as working capital; P is the first cost of the plant per ton of ore; the factor of 0.1 representing amortization and 0.06 interest; and X is the net profit per ton of ore. The values of M, C and P are variable within rather wide limits and are correlated, e.g. an increase of P ought to increase M and decrease C, either or both, and probably will do so. The object of the metallurgist, financier, and economist is always to obtain the maximum for X.

We are inclined to take exception to Professor Parsons' statement that "Zinc mining is frequently done on a royalty basis, an arrangement that means great waste, because the lessee naturally takes out the ore paying the greatest profit and leaves the poorest ore behind without reference to its ultimate loss." We infer that this refers to the Joplin district, where the leasing system is especially in vogue. It has not been our observation that the Joplin lessee wastes in his mining very much to the calamity of coming generations, whatever may be his crimes in milling. Nor that the Joplin lessee is greatly inferior to the larger companies of that district. The Joplin lessee is a natural economist. He is under no illusions respecting deferred charges, or fine points between capital and direct operating accounts, or bookkeeping jugglery in general. He operates always on a liquidating basis and aims to liquidate the maximum possible. He mines an ore of extraordinarily low grade, in which he is materially assisted by the tariff that is beneficent to him. The premium comes out of the consumers, i.e., the public generally. Of course, it will occur to economists that the country might be better off on the whole if the zinc miners were not assisted in mining such low-grade ore; and if the occurrences of such ore were disregarded, for the present at least; and if the interest of future generations in this matter were allowed to go hang.

But to return to Professor Parsons' bulletin, we have found it an interesting publication, full of good reading and suggestive ideas, and so engagingly presented that we have no doubt it would have been accepted by one of the big magazines if it had been offered to them.

Affairs in Mexico

The situation in Mexico appears to have been clarified or confused by the Diaz rebellion and its fiasco, according to the point of view. When the news came of the rebellion under the magic name of Diaz, many persons jumped to the conclusion that it was all up with Madero. When the news came a few days later that Diaz had been arrested with ridiculous ease, the opinion was common that Madero had shown unexpected strength and would make short work of the bandits in the north; and that peace would soon be restored in the unhappy country, and that industry would be free again.

However, the question then arose as to whether to shoot Diaz or not to shoot him, and Madero found himself face to face with another crisis. This may nave been passed before these lines are printed. Anyway, the ease with which Reyes, and after him Diaz, have been overcome, lends color to the belief that the serious part of the Mexican people are tired of fighting and are anxious for the restoration of order; and that the disturbances that continue are only the manifestations of bandit activity, which will be quelled before long.

Safety in Mining

One of the most encouraging features of modern mining practice in the United States is the great increase in attention to the safety of the men. Many important companies have organized their own system of inspection and are striving sincerely to reduce the fatality and accident rates. Prominent in this movement are the iron-mining companies of Michigan, Wisconsin and Minnesota, especially the Cleveland-Cliffs, Republic and Oliver companies. This is just as it should be. The proper way to deal with accidents is to prevent them, and it is better to have private inspection than police, i.e., state inspection, although the latter will, no doubt, continue to be necessary. It is especially gratifying that the big companies are taking the lead in the safeguarding of their men and setting examples for the little fellows to copy.

Cyanide Practice

In this issue begins a series of articles by Herbert A. Megraw, an experienced cyanide metallurgist, who lately joined the staff of the JOURNAL, which will be a review of modern American cyanide practice. Mr. Megraw went first to Cobalt and Porcupine to study the methods introduced at those places, especially at Porcupine, where two large mills have been put into operation this year. Thence he proceeded to the Black Hills, where he is now. Afterward he will visit Colorado, Nevada, and, in short, all of the districts of the United States where cyanidation is the important metallurgical process. Mr. Megraw's articles, based upon intelligent and experienced study in the field, will surely be of great value to cyaniders and should excite general interest.

The breaking of steel rails in service is chiefly a question of section, according to Julius Kruttschnitt, director of maintenance and operation of the Southern Pacific, and John D. Isaacs, consulting engneer of he company. A carefully compiled chart was made of breakages of steel rails of two patterns, both being of practically the same quality and of the same weight, 90 lb. to the yard. With rails of the so called standard section with comparatively light web and base there were six breakages in 100 miles in summer, with an average temperature of 75°; and 23 per 100 miles in winter, with an average temperature of 40°. With the new section, having heavier base and web, the average for both summer and winter was only two breakages per 100 miles. Should this record be corroborated by others, it would show that the railmakers were in the right when they claimed that the engineers in concentrating metal in the head of the rail to take the wear, had unduly weakened the supporting members, the web and the foot of the rail.

By the Way

Prof. A. Tollaire, a French economist, who is now in America making a study of the high cost of living and its probable causes, argues that the gold supply has no relation to the increasing cost of living.

A holiday is always declared by the operating companies in Butte whenever the miners' union decides to take a referendum vote, the companies not wishing to appear to prejudice the vote by keeping the men at work.

The son of the principal stockholder had just taken charge of the mine; he was checking up his bill for the equipment of the new power plant and found that 120 pieces were missing. "I've got all but the 120 volts you said would go with the generator," he wrote the manufacturer.

The German emperor, dispatches announce, is giving his personal attention to mine explosions, and hopes by means of chemistry to find a practical safety device. After the mine disaster near Bochum, on Aug. 8, resulting in the abandonment of the Krupp centenary festivities, the Kaiser is said to have appealed to the technical schools of Germany for a remedy. In a speech made on Oct. 23, at the dedication of the "Chemical Institute of the Emperor William Scientific Foundation," he repeated his request, and explained that his idea contemplated "a harmless chemical compound, a change in which would warn miners plainly of the danger of firedamp."

A Crocker-Wheeler representative tells the following story illustrating the danger of technical terminology in the hands of laymen. Meeting the owner of a sweatshop in a large Western city, to whom he had sold a motor six years before, he asked him how the motor was behaving. "I hardly ever see it," said the latter. "It is up on a shelf in the corner of the room, and I don't bother with it, only to turn it on and off." "How often do you oil it?" inquired the salesman. "Oil it? Why, I never oil it. You told me when you sold it to me that the motor was self-oiling!" A lot of "fully paid, nonassessable" mining stock is sold on much the same understanding.

Speaking of the New York Curb market, the Boston *News Bureau* says it was not many years ago when anyone who looked like ready money, and not a few who did not, did business on the Curb unmolested. When a crook was arrested who happened to be working below the dead line, he invariably styled himself "a Curb broker." To the real Curb brokers this was very distasteful and these happenings went a long way toward the formation of the present association. From $12.50 fees per year, the fee of the association for several years, it was raised to $25 two years ago. Under the new rules, a member must pay $250 initiation fee and $25 annual dues.

The *Wall Street Journal* is authority for the following: "One word summarizes the chief reasons for the present vastly improved situation of copper metal and copper securities and that word is a small one spelled with four letters, and thus, R-Y-A-N," said one of the best known copper men in the Street. "Mr. Ryan can justly claim to have brought order out of chaos and it is only fair tribute to his ability to say that the present situation is largely the result of his foresight, genius and hard work. Without in any way overstepping the bounds of right, he brought into a harmony of views, rich, powerful and opposing interests in the copper trade, with a resultant increasing stability to the copper trade and general increased prosperity on all sides."

Recognition of the high cost of living is reflected in more liberal regulations, issued on Oct. 28 by Secretary MacVeagh to cover travel expenses of officers and employees of the Treasury Department. Allowance for lodging and meals in New York and Chicago, has been increased from $5 to $6 per day, with an additional maximum allowance of 50c. for tips. In a score of other large cities a similar tipping allowance is made. Limited laundry charges will be allowed an official absent one week. Railroad porters may be tipped 15 or 25c., while steamship stewards will receive gratuities ranging from $10@15 for an ocean trip. This official recognition of the tipping system will be a blow to the anti-tipping league. The Washington construction of legitimate traveling expenses will be of interest to many persons.

The greatest of recent improvements in Lake navigation was formally opened on Oct. 18. This is the Livingstone channel in the Detroit River, which has been under construction for four years. It is six miles long, from Stony Island to Bar Point light and runs to the west of Bois Blanc Island, making an independent waterway for down-bound vessels and eliminating the possibility of collision with up-bound vessels at the Limekiln Crossing by avoiding it altogether. That crossing was considered extremely dangerous, owing to the narrow channel, swift current, rocky bottom and the congested conditions arising from the number of vessels waiting for passage in both directions. It is called the Livingstone channel in honor of William A. Livingstone, of Detroit, who first suggested it and was active in securing the necessary appropriations from Congress.

The recent trouble at the South New Moon mine, in Australia, arising out of the objection of the miners to being searched, recalls many yarns about gold stealing in Victoria, says a Melbourne paper. Not so very long ago the directors of a mine in a mountainous district of the state, believing that gold stealing was rife at the mine, secured the services of a private detective. The investigator was given employment at the mine. He worked himself into the confidence of the miners, and helped them to sneak the gold from the workings to the surface. It was necessary for someone to go to Melbourne to dispose of the hoard, and so completely had the spy ingratiated himself with the men that he was entrusted with the booty. He has never been heard of since. Of him it may be truly said—he is greatly missed. His loss is deplored by directors and miners alike. "I knew a Cornishman," writes the Melbourne correspondent, "a real old 'Cousin Jack,' a strange mixture of piety, and craft, and downright thoroughness, who used to point to the Scriptures as an authority for gold stealing. He said: 'The Bible says that thee mussent muzzle the ox that treadeth out the corn, and I take my haff-ounce reg'lar!' And he was such a conscientious man that I believe if his weekly 'taking' weighed over the 'haff ounce," he would have foregone the next week's dividend."

The Kennecott Mines Co. has more than paid back its capital this year; this company, capitalized at $2,500,000, owns the Bonanza mine at Kennecott, Alaska, often referred to as the "richest copper mine in the world." This reference, trite from misuse, is true in this instance—if one does not count the cost of getting its copper out of Alaska. The Bonanza mine doubtless contained the highest-grade copper orebody of its size, so far discovered in the world. Since April, 1911, it has shipped about 29,000 tons, containing approximately 40,000,000 pounds of copper, an average tenor of about 70% copper. In February of this year a dividend of $1,000,000 was paid, being the first return on the big investment made in this property and in the Copper River & Northwestern R.R.; now another dividend amounting to $2,000,000, has been declared, making a total of $3,000,000 or $500,000 more than the Kennecott company's capitalization. The stock in the company is closely held by the Alaska syndicate, composed of Guggenheim officials, and the banking houses of J. P. Morgan & Co., and Kuhn, Loeb & Co. The Bonanza mine is now opened to a depth of over 400 ft. In July, this year, the concentrator commenced treating the lower-grade ore; the concentrates contain about the same amount of copper as the high-grade ore. No official estimates of ore reserves are given out but it is understood that there is a five- or six-year supply already developed, and promising deposits on other portions of the company's property are being investigated.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Pacific Smelting & Mining Co.

My attention having been called to a broker's circular, stating that the Pacific Smelting & Refining Co. (meaning the Pacific Smelting & Mining Co.), has signed a contract for the treatment of its ores, and that shipments will begin on Nov. 1, 1912, I hasten to say for the benefit of those whom it may concern, that said statements are premature. As consulting engineer for that company, and as president of its Mexican subsidiaries, I have been investigating the possibilities of doing what has been erroneously announced as a *fait accompli*. The physical position of the company is excellent, and under certain circumstances, involving some further capital expenditure, it can shortly enter the ranks of the producers. When this end may be in sight, due notice will be given by the officers. I make this statement now in vindication of my own position.

COURTENAY DE KALB.

Tucson, Ariz., Oct. 19, 1912.

Basic Copper Converting

I have been interested in reading the correspondence of Messrs. Fairlie and Bone in the JOURNAL of Aug. 31 and Oct. 12, and the editorial comments on the same. With reference to the JOURNAL'S mention of basic copper converting, I am surprised that it spoke of Peirce and Smith as inventors of this process, which I used at the Parrot works and subsequently described in the 1893 edition of Peters' "Modern Copper Smelting," p. 570. This you will observe was years before Peirce and Smith even started their experiments. In view of this fact, and while not wishing to detract in any way from their merit, I do take exception to the statement which quotes them as originators of this process.

HERMANN A. KELLER.

New York, Oct. 17, 1912.

[All copper metallurgists are acquainted with the pioneer work of Mr. Keller in basic converting and appreciate its value. In our recent reference to Peirce and Smith we had no intention to discuss the history of basic converting or to fix credit, nor do we have any such intention in this note. It is incontestable, we believe, that the development of the practice of basic converting, now so generally in use, followed the work of Peirce and Smith, which was the inspiration or spur, even if it were found subsequently that successful practice was the result of "learning how" rather than of any special apparatus. Earlier metallurgists, including Mr. Keller, may have been suggestive and even anticipatory, and their cumulative work may have paved the way to ultimate success, probably did so, but certainly no extension in practice followed the work of any one of them, which of course is not said in any derogatory spirit. This is the history of most great inventions. In many cases it is impossible to name the real, simon-pure originator. In our recent reference to Messrs. Peirce and Smith we did not intend to limit ourselves to such lexicographic precision. Lest we be thus construed generally, we make haste to retract our use of the word "originator" in this instance.—Editor.]

The Situation in Mexico

I have just read in the ENGINEERING AND MINING JOURNAL of Oct. 5, 1912, an editorial on the situation in Mexico. I am glad to see the article as it strikes me it is high time that some of the mining people take up the conditions in that country as they are unendurable. Taking our own district in Chihuahua—our investment represents considerable over $1,000,000, the last item of indebtedness being some new machinery which cost (or will have cost when erected) about $100,000. This has now been lying on the dump ready to be set up at the mine for 22 months. Water has risen in the mine to where it will require hard pumping for some time. We cannot tell just how long, but we have approximately 40 ft. of water which will mean abot 36,000,000 gals. to be pumped before we can resume operation.

At the present time in the immediate vicinity of the mine are about 500 or 600 rebels, although 40 miles away is a heavily garrisoned town. The mine staff is being continually molested by small parties of rebels to take whatever they can use. They do not take more because there is no more to be taken. The Federals make no effort whatever to protect the mines. They are not protecting the ranches, and in fact are doing absolutely nothing toward the re-establishment of order in the country, and the United States is being filled up along the southern borders with men who have been compelled to come across the line to work.

The New York *Times* came out with a long editorial on Sept. 30, 1912, based upon the information of some eminent professor that the Mexican people were competent to rule themselves, disputing the often made statement that 75% of the population of Mexico was unintelligent. Seventy-five per cent. is too low an estimate for the unintelligent people of Mexico. It is true that President Madero has not had a chance, neither has he attempted to do anything. He is now offering amenity to all of the looters who will promptly start looting again as quickly as they can get funds and ammunition.

AN EMBARGO WHICH DOESN'T WORK

In the last paragraph of your editorial you state that the operations of these plunderers have been retarded very properly by the embargo of the American Government upon the shipment of arms and ammunition to them. The United States is expending some millions of dollars in guarding the border. It is also, in spite of its claim of neutrality, allowing the Mexican Government to import arms and ammunition across the border, and it is not stopping the smuggling of arms and ammunition. The entire border is also being watched by spies of the Mexican Government who are allowed to do just what they please, search the houses of American citizens for arms and ammunition, and they are being aided and abetted by the United States Government. The ordinary statements issued both in the United States and Mexico, concerning the situation there, are absolutely false. The large companies cannot take any definite action against the insurrection as there is nobody to back them up. The Mexican Government either cannot or will not, and the United States Government will not do so. In the meanwhile we are still hearing that "everything is quiet in Mexico and peace will soon be restored."

The last paragraph of your editorial, page 626, just hits me right—"Mexico is a disagreeable and dangerous country in which to live." Last week I was notified that it would be safe for me to stay out of the country. If I had an asbestos envelope and asbestos paper I would tell you the rest.

L. A. GODFREY.

Douglas, Ariz., Oct. 10, 1912.

Notes on Development of Mining Law

By H. C. and L. H. Hoover

From the beginning of history until well into the Nineteenth Century, the growth of mining law has been to give individuals wider and wider rights at the expense of the state. The tendency now is to limit the rights of the individual and exalt those of the community.

Note—This is a footnote that appears in Book IV of Mr. and Mrs. Hoover's translation of Agricola's "De Re Metallica," soon to be published.

There is no branch of the law of property, of which the development is more interesting and illuminating from a social point of view than that relating to minerals. Unlike the land, the minerals have ever been regarded as a sort of fortuitous property, for the title of which there have been four principal claimants —that is, the overlord, as represented by the king, prince, bishop, or what not; the community or the state, as distinguished from the ruler; the landowner; and the mine operator, to which class belongs the discoverer. The one of these that possessed the dominant right reflects vividly the social state and sentiment of the period. The divine right of kings; the measure of freedom of their subjects; the tyranny of the land-owning class; the rights of the community as opposed to its individual members; the rise of individualism; and finally, the modern return to more communal view, have all reflected promptly in the mineral title. Of these parties the claims of the overlord have been limited only by the resistance of his subjects; those of the state limited by the landlord; those of the landlord by the sovereign or by the state; while the miner, ever in a minority in influence as well as in numbers, has been buffeted from pillar to post, his only protection being the fact that all other parties depended upon his exertion and skill.

Mining Rights a Shifting Conception

The conception as to which of these classes had a right in the title has been by no means the same in different places at the same time, and in all it varies with different periods; but the whole range of legislation indicates the encroachment of one factor in the community over another, so that their relative rights have been the cause of never-ending contention ever since a record of civil and economic contentions began. In modern times, practically over the whole world, the state has in effect taken the rights from the overlord, but his claims did not cease until his claims over the bodies of his subjects also ceased. However, he still remains in many places with his picture on the coinage. The landlord has passed through many vicissitudes; his complete right to minerals was practically never admitted until the doctrine of *laissez-faire* had become a matter of faith, and this just in time to vest him with most of the coal and iron deposits in the world; this, no doubt, being also partially due to the little regard in which such deposits were generally held at that time, and therefore to the little opposition to his ever-ready pretentions.

Their numbers, however, and their prominence in the support of the political powers *de jure* have usually obtained them some recognition. In the rise of individualism, the apogee of the *laissez-faire* fetish came about the time of the foundation of the United States, and hence the relaxation in the claims of the state in that country and the corresponding position attained by the landlord and miner. The discoverer and the operator—that is, the miner himself—has, however, had to be reckoned with by all three of the other claimants, because they have almost universally sought to escape the risks of mining, to obtain the most skillful operation, and to stimulate the productivity of the mines; thereupon the miner has secured at least partial consideration. This stands out in all times and all places, and while the miner has had to take the risks of his fortuitous calling, the overlord, state, or landlord have all made for complacent safety by demanding some kind of a tithe on his exertions. Moreover, there has often been a low cunning displayed by these powers in giving something extra to the first discoverer. In these relations of the powers to the mine operator from the very first we find definite records of the imposition of certain conditions with extraordinary persistence—so fixed a notion that even the United States did not quite escape it.

Most Laws Designed to Make Mining Continuous

This condition was, no doubt, designed as a stimulus to productive activity, and was the requirement that the miner should continuously employ himself digging in the piece of ground allotted to him. The Greeks, Romans, mediæval Germans, old and modern Englishmen, modern Australians, all require the miner to keep continuously laboring at his mines, or lose his title. The American, as his inauguration of government happened when things were easier for individuals, allows him a vacation of 11 months in the year for a few years, and finally a holiday altogether. There are other points where the overlord, the state, or the landlord have always considered that they had a right to interfere, principally as to the way the miner does his work, lest he should miss, or cause to be missed, some of the mineral; so he has usually been under pains and penalties as to his methods—these quite apart from the very proper protection to human life, which is purely a modern invention, largely of the miner himself. Somebody has had to keep peace and settle disputes among the usually turbulent miners (for what other sort of operators would undertake the hazards and handicaps?), and therefore special officials and codes, or courts, for his benefit are of the oldest and most persistent of institutions.

Between the overlord and the landowner the fundamental conflict of view as to their respective rights has found its interpretation in the form of the mineral title. The overlord claimed the metals as distinguished from the land, while the landowner claimed all beneath his soil. Therefore, we find two forms of title—that in which the miner could follow the ore regardless of the surface (the "apex" conception), and that in which the boundaries were vertical from the land surface. Right here, lest the Americans think that the apex law was a sin original to themselves, we may mention that it was availed of in Europe a few centuries before Agricola, who will be found to set it out with great precision. From these points of view, more philosophical than legal, we present a few notes on various ancient laws of mines, though space forbids a discussion of a tithe of the amount it deserves at some experienced hand.

Of the ancient Egyptian, Lydian, Assyrian, Persian, Indian and Chinese laws as to mines we have no record, but they were of great simplicity, for the bodies as well as the property of subjects were at the abject disposition of the overlord. We are informed on countless occasions of emperors, kings and princes of various degree among these races, owning and operating mines with convicts, soldiers or other slaves, so we may take it for certain that continuous labor was enforced, and that the boundaries, inspection and landlords did not cause much anxiety. However, herein lies the root of regalian right.

First Historical References in Greek Law

Our first glimpse of a serious right of the subject to mines is among some of the Greek states, as could be expected from their form of government. With republican ideals, a rich mining district at Mount Laurion, an enterprising and con-

tentious people, it would be surprising indeed if Athenian literature was void on the subject. While we know that the active operation of these mines extended over some 500 years, from 700 to 200 B. C., the period of most literary reference was from 400 to 300 B.C. Our information on the subject is from two of Demosthenes' orations—one against Pantænetus, the other against Phænippis—the first mining lawsuit in which the address of counsel is extant. There is also available some information in Xenophon's "Essay upon the Revenues," Aristotle's "Constitution of Athens," Lycurgus' prosecution of Diphilos, the Tablets of the Poletæ, and many incidental references and inscriptions of minor order. The minerals were the property of the state, a conception apparently inherited from the older civilizations. Leases for exploitation were granted to individuals for terms of three to 10 years, depending upon whether the mines had been previously worked, thus a special advantage was conferred upon the pioneer. The leases did not carry surface rights, but the boundaries at Mt. Laurion were vertical, as necessarily must be the case everywhere in horizontal deposits. What they were elsewhere we do not know. The landlord apparently got nothing. The miner must continuously operate his mine, and was required to pay a large tribute to the state, either in the initial purchase of his lease or in annual rent. There were elaborate regulations as to interference and encroachment, and proper support of the workings. Diphilos was condemned to death and his fortune confiscated for robbing pillars. The mines were worked with slaves.

Early Roman Operations

The Romans were most intensive miners and searchers after metallic wealth already mined. The latter was obviously the objective of most Roman conquests, and those nations rich in these commodities, at that time necessarily possessed their own mines. Thus a map showing the extensions of empire coincides in an extraordinary manner with the metal distribution of Europe, Asia and North Africa. Further, the great indentations into the periphery of the imperial map, though many were rich from an agricultural point of view, had no lure to the Roman because they had no mineral wealth. On the Roman law of mines, the student is faced with many perplexities. With the conquest of the older states, the plunderers took over the mines and worked them, either by leases from the state to public companies or to individuals; or even, in some cases, worked them directly by the state. There was thus maintained the concept of state ownership of the minerals which, although apparently never specifically defined, yet formed a basis of support to the contention of regalian rights in Europe later on. Parallel with this system mines were discovered and worked by individuals under tithe to the state, and in Pliny (XXXIV, 49) there is reference to the miners in Britain limiting their own output. Individual mining appears to have increased with any relaxation of central authority, as for instance, under Augustus.

Romans Had Mining Officials

It appears, as a rule, that the mines were held on terminable leases, and that the state did at times resume them; the labor was mostly slaves. As to the detailed conditions under which the mine operator held his title, we know less than of the Greeks—in fact, practically nothing other than that he paid a tithe. The Romans maintained in each mining district an official—the *Procurator Metallorum*—who not only had general charge of the leasing of the mines on behalf of the state, but was usually the magistrate of the district. A bronze tablet found near Aljustrel, in Portugal, in 1876, generally known as the Aljustrel Tablet appears to be the third of a series setting out the regulations of the mining district. It refers mostly to the regulation of public auctions, the baths, barbers and tradesmen; but one clause (VII) is devoted to the regulation of those who work dumps of scoria, etc., and provides for payment to the administrator of the mines of a *capitation* on the slaves employed. It does not, however, so far as we can determine, throw any light upon the actual regulations for working the mines.[1]

Despite the systematic law of property evolved by the Romans, the codes contain but a small reference to mines, and this in itself is indirect evidence of the concept that they were the property of the state. Any general freedom of the metals would have given rise to a more extensive body of law. There are, of course, the well known sections in the Justinian and Theodosian codes, but the former in the main bears on the collection of the tithe and the stimulation of mining by ordering migrant miners to return to their own hearths. There is also some intangible prohibition of mining near edifices. There is in the Theodosian Code evident extension of individual right to mine or quarry, and this "freeing" of the mines was later considerably extended. The Empire was, however, then on the decline; and no doubt it was hoped to stimulate the taxable commodities. There is nothing tangible as to the position of the landlord with regard to minerals found on his property; the metals were probably of insufficient frequency on the land of Italian landlords to matter much, and the attitude toward subject races was not usually such as to require an extensive body of law.

Medieval Rulers Asserted Ownership of Mines

In the chaos of the Middle Ages, Europe was governed by hundreds of potentates, great and small, who were unanimous on one point, and this that the minerals were their property. In the bickerings among themselves the stronger did not hesitate to interpret the Roman law in affirming regalian rights as an excuse to dispossess the weaker. The rights to the mines form no small part of the differences between these potentates and the more important of their subjects; and with the gradual accretion of power into a few hands, we find only the most powerful of vassals able to resist such encroachment. However, as to what position the landlord or miner held in these rights, we have little indication until about the beginning of the 13th century, after which there appear several well known charters, which, as time went on, were elaborated into practical codes of mining law. The earliest of these charters are those of the Bishop of Trent, 1185; that of the Harz Miners, 1219; of the town of Iglau in 1249. Many such in connection with other districts appear throughout the 13th, 14th and 15th centuries[2].

By this time a number of mining communities had grown up, and the charters in the main are a confirmation to them of certain privileges; they contain, nevertheless, rigorous reservation of the regalian right. The landlord where present was usually granted some interest in the mine, but had to yield to the miner free entry. The miner was simply a sort of tributer to the Crown, loaded with an obligation when upon private lands to pay a further portion of his profits to the landlord. He held tenure only during strenuous operation. However, it being necessary to attract skilled men, they were granted many civil privileges not general to the people; and from many of the principal mining towns "free cities" were created, possessing a measure of self-government. There appear in the Glau charter of 1249 the first symptoms of the "apex" form of title, this being the logical development of the conception that the minerals were of quite distinct ownership from the land. The law, as

[1] Those interested will find ample detail in Jacques Flach, "La Table de Bronze d'Aljustrel: Nouvelle Revue Historique de Droit Francais et Etranger," 1878, p. 655; "Estacio da Veiga, Memorias da Acad. Real das Cien. cas de Lisbon, Nova Serie, Tome V, Part II," Lisbon, 1882.

[2] References to the most important of such charters may be found in Sternberg, "Umrisse der Geschichte des Bergbaues." Prague, 1838; Eisenhart, "De Regali Metalli Fodinarium." Helmestadt, 1681; Gmelin, "Beyträge zur Geschichte des Teutschen Bergbaus," Halle, 1783; Inama-Strenegg, "Deutsche Wirtschaftsgeschichte," Leipzig, 1879-1901; "Transactions, Royal Geol. Soc. Cornwall," VI, 155; Lewis, "The Stannaries," New York, 1908.

outlined by Agricola, is much the same as set out in the Iglavian Charter of three centuries before, and we must believe that such fully developed conceptions as that charter conveys were but the confirmation of customs developed over generations.

In France, the landlord managed to maintain a stronger position *vis-a-vis* the Crown, despite much assertion of its rights; and, as a result, while the landlord admitted the right to a tithe for the Crown, he maintained the actual posession, and the boundaries were defined with the land.

Old English Law Probably Autochthonous After Roman Evacuation

In England the law varied with special mining communities, such as Cornwall, Devon, the Forest of Dean, the Forest of Mendip, Alston Moor, and the High Peak, and they exhibit a curious complex of individual growth of profound interest to the student of the growth of institutions. These communities were of ancient origin, some of them at least pre-Roman; but we are, except for the reference in Pliny, practically without any idea of their legal doings until after the Norman occupation (1066 A.D.). The genius of these conquerors for systematic government soon led them to inquire into the doings of these communities, and while gradually systematizing their customs into law, they lost no occasion to assert the regalian right to the minerals. In the two centuries subsequent to their advent there are on record numerous inquisitions, with the recognition and confirmation of "the customs and liberties which had existed from time immemorial," always with the reservation to the Crown of some sort of royalty. Except for the High Peak in Derbyshire, the period and origin of these "customs and liberties" are beyond finding out, as there is practically no record of English history between the Roman withdrawal and the Norman occupation. There may have been "liberties" under the Romans, but there is not a shred of evidence on the subject, and our own belief is that the forms of self-government which sprang up were the result of the Roman evacuation.

The miner had little to complain of in the Norman treatment in these matters; but between the Crown and the landlord as represented by the barons, lords of the manor, etc., there were wide differences of opinion on the regalian rights, for in the extreme interpretation of the Crown it tended greatly to curtail the landlord's position in the matter, and the success of the Crown on this subject was by no means universal. In fact, a considerable portion of English legal history of mines is but the outcropping of this conflict, and one of the concessions wrung from King John, at Runnymede, in 1215, was his abandonment of a portion of such claims.

Early Cornwall and Devon had Self Government

The mining communities of Cornwall and Devon were early in the 13th century definitely chartered into corporations — "The Stannaries" — possessing definite legislative and executive functions, judicial powers, and practical self-government; but they were required to make payment of the tithe in the shape of "coinage" on the tin. Such recognition, while but a ratification of prior custom, was not obtained without struggle, for the Norman kings early asserted wide rights over the mines. Tangible record of mining in these parts, from a legal point of view, practically begins with a report by William de Wrotham in 1198 upon his arrangements regarding the coinage. A charter of King John in 1201, while granting free right of entry to the miners, thus usurped the rights of the landlords—a claim which he was compelled by the Barons to moderate; the Crown, as above mentioned did maintain its right to a royalty, but the landlord held the minerals. It is not, however, until the time of Richard Carew's "Survey of Cornwall" (London, 1602) that we obtain much insight into details of miners' title, and the customs there set out were maintained in broad principle down to the 19th century. At Carew's time the miner was allowed to prospect freely upon "Common" or wastrel lands (since mostly usurped by landlords), and upon mineral discovery marked his boundaries, within which he was entitled to the vertical contents. Even upon such lands, however, he must acknowledge the right of the lord of the manor to a participation in the mine. Upon "enclosed" lands he had no right of entry without the consent of the landlord; in fact, the minerals belonged to the land as they do today except where voluntarily relinquished. In either case he was compelled to "renew his bounds" once a year, and to operate more or less continuously to maintain the right once obtained.

The High Peak Mining Community in Derbyshire

There thus existed a "labor condition" of variable character, usually imposed more or less vigorously in the bargains with landlords. The regulations in Devonshire differed in the important particular that the miner had right of entry to private lands, although he was not relieved of the necessity to give a participation of some sort to the landlord. The Forests of Dean, Mendip, and other old mining communities possessed a measure of self-government, which do not display any features in their law fundamentally different from those of Cornwall and Devon. The High Peak lead mines of Derbyshire, however, exhibit one of the most profoundly interesting of these mining communities. As well as having distinctively Saxon names for some of the mines, the customs there are of undoubted Saxon origin, and as such their ratification by the Normans caused the survival of one of the few Saxon institutions in England—a fact which, we believe, has been hitherto overlooked by historians. Beginning with inquisitions by Edward I. in 1288, there is in the Record Office a wealth of information, the bare titles of which form too extensive a list to set out here.[3]

Old High Peak Laws a Saxon Survival

The miners in this district were presided over by a "barmaster," "barghmaster," or "barmar," as he was variously spelled, all being a corruption of the German bergmeister, with precisely the same functions as to the allotment of title, settlement of disputes, etc., as his Saxon progenitor had, and, like him, he was advised by a jury. The miners had entry to all lands except churchyards (this regulation waived upon death), and a few similar exceptions, and was subject to royalty to the Crown and the landlord. The discoverer was entitled to a finder's "meer" of extra size, and his title was to the vein within the end lines, *i.e.*, the "apex" law. This title was held subject to rigorous labor conditions, amounting to forfeiture for failure to operate the mine for a period of nine weeks. Space does not permit of the elaboration of the details of this subject, which we hope to pursue elsewhere in its many historical bearings. Among these we may mention that if the American "apex law" is of English descent, it must be laid to the door of Derbyshire, and not of Cornwall, as is generally done.

It is not our purpose to follow these inquiries into mining law beyond the 15th century, but we may point out that with the growth of the sentiment of individualism the miners and landlords obtained steadily wider and wider rights at the cost of the state, until well within the 19th century. The growth of stronger communal sentiment since the middle of the last century has already found its manifestation in the legislation with regard to mines, for the laws of South Africa, Australia and England, and the agitation in the United States are all toward greater restrictions on the mineral ownership in favor of the state.

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[3]Of published works, the most important are Edward Manlove's "The Liberties and Customs of the Lead Mines within the Wapentake of Wirksworth," London, 1653; generally referred to as the "Rhymed Chronicle"; Thomas Houghton, "Rara Avis in Terra," London, 1687; William Hardy, "The Miner's Guide," Sheffield, 1748; Thomas Tapping, "High Peak Mineral Customs," London, 1851.

American Institute of Mining Engineers

The 103d meeting of the American Institute of Mining Engineers convened Tuesday morning, Oct. 29, at the Hotel Statler, Cleveland, Ohio, and indications are for a memorable convention. As is perhaps well known, this meeting of the institute has particular reference to its newly created Iron and Steel Division, and this is well emphasized by the facts that the meeting is being held in Cleveland, an iron and steel center, and a program of 50 papers, most of which have a direct bearing upon iron ore and its manufactured products. The registration is about 150, with the probability of its becoming 200 before the sessions close.

At the opening session on Tuesday morning, D. T. Croxton, chairman of the local executive committee, extended a formal welcome to members of the society, and Mayor Newton D. Baker delivered the official welcoming address on behalf of the city. This was replied to by Prof. James F. Kemp, president of the institute.

Steel Rail Inspection

"Recent Developments in the Inspection of Steel Rails" was the subject of a paper presented by Capt. Robert W. Hunt, of Chicago. Captain Hunt directed special attention to a new system of rail inspection, which has been adopted by 33 railroad systems operating more than 122,000 miles of track. The system provides for placing inspectors in each department of rail plants, to be on duty during all working hours. All operations are carefully watched, and any serious variation from specifications is brought to the foreman's attention and a record made of the occurrence.

The inspectors' observations are also reported in writing to the purchaser, and, if necessary, to the official in charge of the works, so as to provide for immediate investigation. In this way it will be possible to trace the history of all rails, defective or otherwise. The plan is said to be working satisfactorily. The Chicago, Milwaukee & St. Paul R.R. Co. has ordered 10,000 tons of rails from the Illinois Steel Co., to contain 0.5% copper, in the belief that better results can be obtained.

Other papers presented and discussed at the morning session were: "Notes on Titanium and the Cleansing Effect of Titanium on Cast Iron," by Bradley Stoughton; "The Action of Various Commercial Carbonizing Materials," by Robert R. Abbott; "Measurements and Relations of Hardness and Depth of Carbonization in Case-Hardened Steel," by Mark A. Ammon; "Notes on Ruff's Carbon-Iron Equilibrium Diagram," by Henry M. Howe, and "Translation of N. M. Wittorff's Preliminary Investigation of Primary Crystallization in Iron-Carbon Alloys Containing more than 4 per cent. of Carbon," by Bradley Stoughton and Simon Marcus.

Tuesday Afternoon Session

The afternoon session was called to order by President Kemp and the first paper presented was "Blowing in of a Blast Furnace," by R. H. Sweetser, of Columbus, Ohio. Mr. Sweetser described the method which he has used with considerable success, and in one instance the first cast was secured in the remarkably short time of 13 hr. after the blast was turned on. A discussion of "Alloys of Cobalt with Chromium and Other Metals," by Elwood Haynes, Kokomo, Ind., described the extraordinary results obtained by the author with these alloys. One alloy in particular, "stellite," is a combination of cobalt and chromium, the result being a malleable metal. The addition of molybdenum or tungsten in varying proportion, causes this alloy to become hard. The alloy takes an excellent cutting edge, capable of cutting nickel and chrome steel, shavings of which were exhibited, as well as various articles, such as knife blades, machine tools, etc.

The papers which aroused the most interest in the afternoon, however, were a series of three as follows: "Manufacture of Coke," by William Hutton Blauvelt, Syracuse, N. Y.; "Byproduct Coke," by C. W. Andrews, Duluth, Minn., and "The Manufacture of Coke," by F. E. Lucas, Sydney, N. S. Two of the authors were absent and all three papers were read in abstract, discussion being deferred until after the series had been completed.

The discussion which followed was participated in by many, and grew exceedingly technical toward the end. It centered chiefly around Mr. Blauvelt's paper, which treated of byproduct ovens and coke, as opposed to the old beehive method. It was pointed out in the discussion that certain procedures advocated by Mr. Blauvelt are contrary to what has been supposed to be good practice, in the by-product-oven system.

N. V. Hansell, of New York, read in abstract, a paper on "The Concentration of Iron Ores," in which he reviewed at some length the various methods employed in this country, Canada and Norway, to recover profitably iron from low-grade ores. He also went into the question of crushing, washing, jigging, dry concentration, and finally magnetic separation, as applied to such ores. Interesting data were included on particular plants. His paper brought out some discussion as to why expensive processes are now employed on ores running, say 40% iron, when the old log-washing process was formerly employed satisfactorily on much lower-grade ores. This matter was not cleared up.

The last paper presented at the afternoon session was on "The Effect of Alumina in Blast-Furnace Slags," by J. E. Johnson, Jr., Ashland, Wis. The discussion of this paper was shortened by the lateness of the hour, but it evidently opened up a question of great importance to furnace men.

On Tuesday evening an informal smoker was held at the Statler Hotel, at which moving pictures, entitled "From Mine To Molder" were exhibited by Rogers, Brown & Co., Cincinnati, under the supervision of H. B. Yergason. The business and technical sessions will continue through Thursday, with numerous inspection trips interspersed, and on Wednesday evening a subscription banquet will be given at the Statler Hotel.

Rhodesian Mining Notes

Johannesburg Correspondence

The Asp mine, in the Mazoe district, north of Salisbury, is stated to be one of the most promising of the newer developing mines. Along several lines of ancient workings, four separate pay shoots are being opened at the 100-ft. level. The development aggregates 2020 ft. in length with an average value of 10 dwt. over 40 in. If this grade continues in depth, the mine should supply 20 stamps.

The Cam & Motor mine, in the Gatooma district, is undoubtedly the most promising mine in Rhodesia. Ore reserves are now 1,000,000 tons, worth 40s. per ton. On the fifth or lowest level one of the ore lenses along a length of 400 ft. averages 45 ft. in width. In one section the ore is 91 ft. wide, assaying 10.4 dwt. An experimental all-roasting plant on West Australian lines is treating the ore successfully and a large plant is ordered.

The copper-smelting furnaces at the Star of Congo mine, in Katanga, were stopped for some time, owing to an explosion in the flues. Smelting has now been started with coke from Wankies, in southern Rhodesia.

Mr. Maufe, the Rhodesian government geologist, has issued a report on the Victoria tin field, in southeastern Rhodesia. He states that it consists of an area of metamorphic rocks belonging to the epidiorite and banded ironstone groups, bounded on three sides by gray biotite granite. Pegmatite dikes and sills are found along the margins of the granite and are intruded into the metamorphic rocks for some distance. The latter series is more or less altered to greisen and carries much pink and green lithia mica and cassiterite. The former series is unaltered and barren. The whole occurrence is similar to that in the Enterprise district. As regards the tin contents, though blocks of ore weighing 200 lb. have been found, the ore occurrences are patchy and erratic and the average grade must be

low. The dikes and flat sills average from six to 15 ft. in width and do hold out possibilities of large low-grade, but payable, orebodies being developed.

The ore mined last year at the Wanderer mine, in the Selukwe district, assayed only 2.61 dwt. and of this about two pennyweights were recovered. The costs were 7s. 6.4d. per ton, including 9.86d. development, but not London office expenses.

Copper River Basin, Alaska

As a result of prospecting in the mountains south of Chitina River, Alaska, copper was found east of Taral in 1898, and a few years later the gold placers of Bremner River were discovered. No copper has yet been produced in the Copper River Basin, according to Fred H. Moffit, of the U. S. Geological Survey, but interest in prospecting and development has been stimulated during the last year by the transportation facilities offered by the Copper River & Northwestern Ry.

Golconda Creek, a tributary of the Bremner River, has yielded most of the gold so far produced in this district, although Little Bremner River has contributed a part. Gold in commercial quantities has not been found near Taral nor between the Chitina and the Bremner, in Hanagita Valley. The total production of the district is not known, but several thousand dollars' worth of gold has been produced each year since mining began. The high cost of supplies and difficulty of access have done much to discourage prospectors.

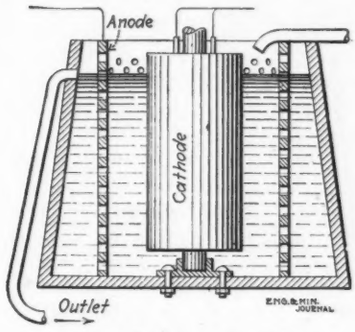
All the gold so far produced in the Bremner River Valley has been obtained from stream gravels. This valley is practically unprospected, so far as lode deposits are concerned. The three parts of the valley of present or prospective importance, because of known placer-gold deposits, are Golconda Creek, Little Bremner River, and the lower part of Bremner, above the Little Bremner.

Electric Smelting of Zinc Ores

The possibility of treating blende in the electric furnace, according to the principle embodied in the precipitation process—by smelting it together with metallic iron without previous roasting—has been recognised by metallurgists since 1907, says the *Mining Journal*, Sept. 28, 1912. More recently Eulenstein has tried to dissolve the iron required for the reaction in the sulphide of iron produced during the precipitation process according to the equation ZnS + Fe=FeS + Zn, and to bring the dissolved Fe in the electric furnace into contact with the ZnS, which is also dissolved in the molten sulphide of iron. As a result of Eulenstein's experiments and investigations it appears that the solutions of Fe in FeS affect blende in such a manner that the zinc is distilled off. The influence becomes effective at a temperature of from 1300°c. upwards. With increasing Fe contents in FeS—up to a maximum concentration limit of 45%—the effect of the solution grows stronger, while the minimum limit of efficiency is 5% of Fe. To facilitate the carrying out of the process F. Thomas has constructed a special electric furnace whose length can be regulated as in each case required by the available voltage and the conductivity of the melting-bath.

Lacroix's Electrolytic Cell

In the recently patented electrolytic cell of Fernand Lacroix, of Paris (U. S. pat. 1,019,969,) the attempt is made to get an efficient apparatus with which to deposit, using insoluble anodes. The cathode is a rotating cylinder, and the anode is a concentric perforated plate. The



LACROIX ELECTROLYTIC CELL

electrolyte is admitted into the tank as near the cathode as possible, and is drawn off outside the anode, after passing through the perforations in it. If there is to be any anodic regeneration of the electrolyte, such as in ferrous-ferric solutions, this insures the complete treatment of all the solution.

Aluminum Foil and Powder

Specimens of aluminum foil, now being placed upon the market as a substitute for tin foil, have recently been brought to our attention. This foil retains the fine white color of the metal, has a great covering power for a small weight of material, and although somewhat stiffer as rolled than tin foil of the same thickness, it is still highly pliable, and it appears that a great deal of the original stiffness can be removed by careful annealing. Owing to the present high price of tin, it is said that the aluminum foil is largely supplanting it for wrapping cheese, chocolate, and other articles of food.

It required long experimenting before it was possible to make thin sheets, but it is now being rolled as thin as 0.04 mm. (0.0016 in.) in thickness at the La Paz works, France. It is also said that still thinner sheets can be obtained by laying several sheets together and rolling them down as a whole, or by beating them as is done by gold leaf.

It is understood that thin sheets (0.01 mm. thick) produced in this way, are cut into small squares and rubbed to powder, to use for aluminum paint.

Number of Mines in the United States

From the advance sheets of the report on mining in the United States, made by the U. S. Bureau of the Census, we take the accompanying table of the number of mines in the United States, producing and nonproducing:

MINES OF THE UNITED STATES

Kind	Producing	Nonproducing
Iron	483	21
Copper	368	13
Prec. Met. Lode	2845	8352
Prec. Met. Placer	880	192
Lead and Zinc	1142	71
Quicksilver	12	28
Manganese	8	9
Asbestos	20	76
Barytes	42	....
Corundum	6	....
Feldspar	28	1
Fluorspar	15	3
Garnet	4	1
Graphite	20	6
Gypsum	222	6
Magnesite	13	1
Mica	78	4
Mineral Paints	26	....
Monazite	4	1
Phosphate	153	33
Pyrites	12	1
Quartz	14	1
Sulphur	4	....
Talc	46	....
Tungsten	116	84
	6561	8904

Although there is a distribution of operators by states, in the more important industries, there is no distribution of mines on a similar basis, so that it is impossible to break up the above list by geographical divisions.

Westralian 1911 Mineral Output

The value of the West Australian mineral production for 1911 was £6,105,583, a decrease of £416,410 from 1910. Gold furnished 95.36% of this figure, £5,823,075, and also accounted for the decrease by falling off £423,773. Dividends paid by West Australian companies amounted to £826,376.

The gold output was 1,370,868 fine oz. Coal was the next valuable product, 249,890 tons. The other minerals follow in decreasing value: Copper ore, matte and ingots, 10,653 tons; tin ore and ingots, 495 tons; silver, 169,043 fine oz.; lead ore, 1549 tons; pyrite, 9939 tons; wolfram ore, zinc ore and other miscellaneous items, £1422. The mineral exports, exclusive of coal, form 67.61% of the total exports of the colony.

American Iron and Steel Institute

The fall meeting of the American Iron & Steel Institute was held at Pittsburgh, Oct. 26. There were two sessions devoted to business, and a dinner in the evening, at which a number of addresses were made.

Presidential Address by Judge Gary

At the morning session, after the usual preliminary addresses of welcome and responses, President E. H. Gary delivered his address, in which he referred to the dominating position of Pittsburgh in the steel industry. He also spoke of the success of the institute. The more striking paragraphs of Judge Gary's address were as follows:

"We are here under conditions that are most gratifying. We are in the midst of an era of prosperity never before surpassed so far as it affects our particular lines. These conditions have not resulted from the application of political policies or efforts, but exist in spite of them. They are here because nothing could prevent. In the first place, for the last few years, following the bankers' panic of 1907, there have existed a feeling of uncertainty and a lack of confidence, which have deterred the great purchasing public from entering the market, even to the extent of supplying its necessities. This has been especially true of the railroad companies, which are among our largest patrons. In consequence, the necessities of the consumers have piled up to such an extent that they have lately been forced to increase their purchases materially. When, therefore, the railroad companies and others similarly situated commenced to buy, the general influence and effect were immediately felt, and buying on a large scale has developed. Moreover, the bountiful crops and sound basic conditions of the country have made everyone realize more clearly than ever before that prosperity in this splendid country of ours is to be the rule and not the exception, notwithstanding at times we may be surrounded by adverse influences and unwarrantable interference, which in any ordinary country would bring prolonged distress and suffering. So we are happy today in the knowledge that we have on our books orders which will keep our mills running to their full capacity for months to come. Let us hope and pray that nothing shall be done to interfere with our continued success. . . . .

"But neither the technical questions connected with, nor even the material growth of, our business should be treated as the all-important, or the most important, subjects which must be considered and passed upon by the members of the institute. Questions of great magnitude and concern are at present agitating the minds of the people throughout the world. We may be stubbornly oblivious to some of them, but we ought not to be. We refuse to consider, or at least postpone consideration of many of them. The questions are international, national and domestic; and they involve the welfare of everyone. We are disposed to wrap around ourselves the cloak of self-righteousness; or we proclaim that we rely upon the stability of government or the majesty of the law; and we consider ourselves safe, whether within our vision everything seems to be calm and tranquil, or otherwise. We sometimes forget that it is the masses of the people who determine final results; that they may establish and abolish governments; that they may make and unmake constitutions. Sooner or later they bring about conditions satisfactory to them, even by resorting to destructive measures. They have the might and they can determine for themselves what is the right. They believe in the sentiment, to quote from a French writer on French history, that 'There is a bigotry in politics as well as in religion, and it is the worst of bigotry to reject change as something which is inherently bad. Laws to be permanently useful must vary with the varying condition of man.'

"I am dealing in generalities, not intending to be specific or to make personal reference. The thought I would leave with you is that there is no way of permanently settling any great question involving the welfare of humankind except on the basis of right and justice. Position, wealth, influence, laws are helpless as a means of establishing a rule for human conduct unless supported by principles of justice and righteousness. The unfair or unreasonable or dishonest man, whether in public life or private, may succeed temporarily; but it is only a question of time when he will be discovered and overthrown. The members of this institute have, and will continue to have in an increasing measure, great influence in the solution of the problems of today and the future; and you will give good account of ourselves. In our daily walk and conversation, in our attitude and demeanor toward all with whom we come in contact, each of us must be certain he is governed by motives which are honorable and just. You have made and are making great strides in the direction which I have indicated. You have secured and will hold the respect of all who know you, and, better than that, you have the approval of your own consciences."

Papers Read

The session continued all day, with only a brief intermission. The first paper read was: "The Buyer from a Manufacturers' Standpoint," by John L. Haines, of the Jones & Laughlin Steel Co., in which the writer urged more regular purchases. The provision for future needs and the consequent prevention of irregular and spasmodic buying and rush demands on the mills. He also deprecated too strict specifications, and advocated a closer adherence to contracts, which should be regarded as positive obligations and not merely as options to take certain materials at specified prices.

J. M. Camp, of the Carnegie Steel Co., described the methods by which that company's salesmen are given a training in the technical side of the business, which enabled them to discuss conditions with buyers in an intelligent way.

A paper, by Stewart C. Cory, of the Youngstown Sheet & Tube Co., on "Electric Power Production and Distribution in Steel Mills," treated of the applications of the electric motor in rolling mills, and discussed at considerable length the relative cost of power production by gas engines using blast-furnace gas directly, and by steam turbines run by steam made in boilers fired with the gas. His conclusions were generally in favor of the steam turbine.

Quality of Iron and Steel made from Cuban Ores

Quincy Bent, of the Maryland Steel Co., described experimental work with iron made with ores from the Mayari mine, in Cuba, which carry small percentages of chromium and nickel. Good results had been obtained in making steel from this iron and also in castings for rolls and other work requiring exceptional hardness, and in casting chilled work.

Other papers presented were: "The Manufacture of Ordnance at the Bethlehem Steel Works," by E. G. Grace, vice-president and general manager, Bethlehem Steel Co. "Coal-Mine Ventilation in the Connellsville Coke Region," by Austin King, chief mine inspector H. C. Frick Coke Co. Discussion led by Wilson A. Luce, general manager Ellsworth Collieries Co. "Recent Developments in the Preparation of Iron Ores," by J. W. H. Hamilton, mining engineer. "Microscopic Analysis of Steel Sheets," by C. Arthur White, American Sheet & Tin Plate Company.

At the dinner in the evening, no speeches of importance were made. The time was largely taken up by the Rogers-Brown moving-picture exhibit, illustrating the mining of ore and its treatment in the blast furnace.

On Saturday, Oct. 26, parties of members of the institute visited various points of interest in and around Pittsburgh. The new works of the Jones & Laughlin Steel Co., at Aliquippa, were visited by a large party.

Other works were also examined, and some of the members continued their trip as far as Gary.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Loading Cars from Three Track Approach

In the mines of the St. Louis Smelting & Refining Co., in the Flat River district of southeastern Missouri, a three-track approach to the shaft is used as the ground stands well, so that the shaft station may be made extra wide. The ore cars are drawn by an electric motor in trains of 1-ton cars on tracks of 24-in. gage. The loaded cars are pushed in trains ahead of the locomotive, on to the middle track, while empty cars are pulled from the cages and are generally put on the outside tracks, although, in some instances, when it can be done without too much cutting out of ore, the end cars are pushed off the other side of the track from which the loaded cars are put on. The empties run on a track, the grade of which is in their favor, and need no further handling until the trainmen hook them up into trains, when the locomotive, after delivering a loaded train on the center track, has passed around the shaft pillar and begins to gather the empties. The grade of the center track is in favor of the loaded cars, while the grade of the outside tracks is against the empties.

When the loading and pulling off is done from the same side of the shaft, the head end of the three-track approach, which is 100 ft. long in some instances, has to be fitted with a three-way switch, as shown in Fig. 2, at the point where the two tracks make off from the single track. The curves on this track can be made easy, so as to favor the track and the locomotive. In the accompanying drawings the arrangement of the track and the frogs is shown. At the loading end of the three-track yard, as the approach might be called, the crossovers, as shown in Fig. 1, have to be made abrupt, so that the switching from one track to the other may be done in a minimum of space and as near the shaft as possible, to minimize the distance that the cagers must walk to get an empty car and a loaded car off the cage.

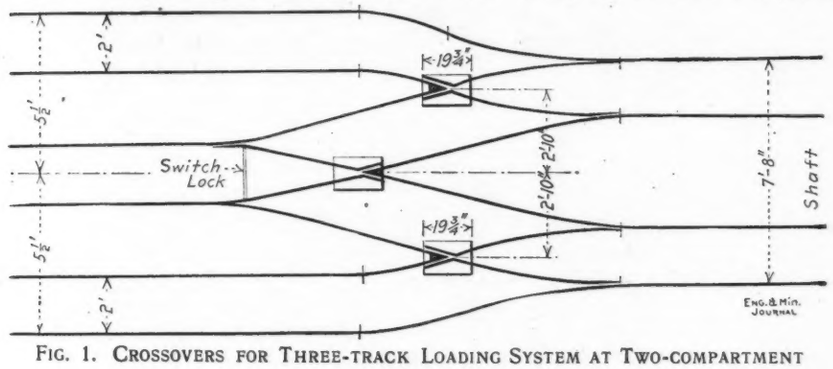


FIG. 1. CROSSOVERS FOR THREE-TRACK LOADING SYSTEM AT TWO-COMPARTMENT SHAFT

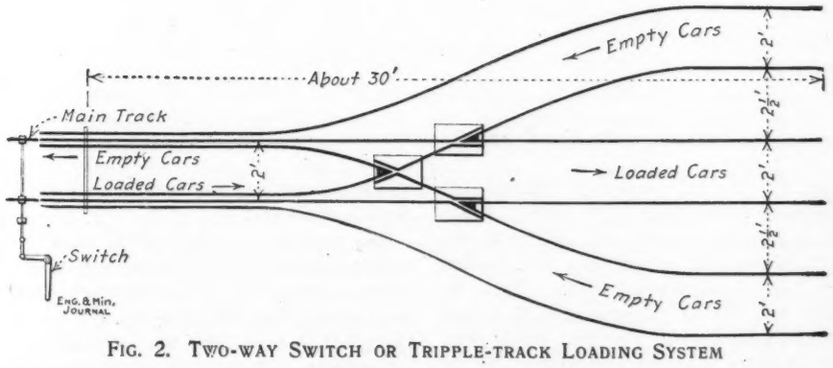


FIG. 2. TWO-WAY SWITCH OR TRIPPLE-TRACK LOADING SYSTEM

In the drawings the dimensions are given that have been found best for loading cages at greatest speed. At first a distance of 13 ft. from the shaft to point of middle frog was tried, but this was found to be too great and was shortened to 11 ft. This has been found to be just about right, as the curving off begins almost as soon as the cars clear the shaft. The distance to the outside rail in the three-track straightway is also 11 ft. This gives plenty of clearance between cars. In the loading crossovers a kick switch is needed to join the middle track with the track that connects it with the shaft. This kick switch, which is thrown with the foot, is shown in Fig. 2 of the accompanying drawing. The cagers throw it with one foot and after running the empty car out on the outside track on the same side of the shaft that it came from, cross over to the center track to get the loaded car.

Tne Smoko Gravel Shaker

The Smoko No. 2 dredge, in Victoria, is treating mainly a coarse gravel outcrop; it often lost time by the gravel staying too long in the sluice box, as the ordinary supply of water was insufficient to keep the box clear. The apparatus to prevent this is described in the report of the Victoria Secretary of Mines. A perforated box, called a "shaker," has been placed above the sluice box, and when this is agitated, the heavier material discharges over the end, while the finer material is dropped through the perforations to the sluice box.

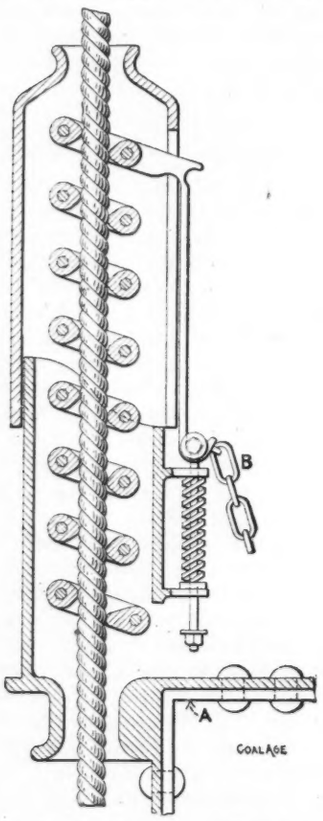
The shaker is suspended above the sluice box from a timber frame by hinged hangers 20 in. long. Its length is 46 ft., its width 6 ft. and depth about 14 in. It moves with a stroke of 3 in., 135 oscillations per minute, and is worked by eccentrics, belt driven from the pump engine with intermediate gear. A sparge pipe, 5 ft. above the shaker, extends the full length, and water, lifted by a 12-in. pump, is sprayed over the whole surface from the sparge pipe, carrying the fine material through the perforations into sluice box beneath, while the "shaker" discharges the stones at the end. The perforations are round holes ⅜ in. diameter, except in the last 4 ft., where they are ¼-in. diameter. At the end of the sluice box there are two sand shoots, one on either side, each 2½ ft. wide, to carry the fine material and the water 27 ft. beyond the place where the larger stones are discharged from the shaker. The sluice box is hinged at the lower end, so that the upper end may be lowered when the box is to be cleaned.

Originally eccentrics worked the shaker, which were flattened at the ends and riveted to the box, but they were frequently broken, so that bearings were put in on these eccentrics. The first

screen holes were 1-in. diameter, but this was found to be much too large. The manager states that about two horsepower are required to work it. The only fault is that flat stones are not turned over as they would be in a revolving screen, and are imperfectly washed if covered with clayey material. The apparatus was made by the Maori Iron Works, Port Chalmers, New Zealand.

Safety Catches for Rope Guides

The accompanying illustration shows a device patented by L. S. Rayner, Gaergwrle, England, designed to answer the same purpose for shafts having rope guides that the ordinary safety dogs do for the shaft equipped with timber guides.



SAFETY DEVICE FOR CAGES

One end of the apparatus is connected to the cage *A*, while the other end has a spring arrangement and a system of lever connections, which come into action by means of the chain *B*, when the hoisting rope breaks, says *Coal Age*, Sept. 21, 1912. The weight of the falling cage thus causes the device to extend and grip the guide rope, arresting the descent of the cage.

The concrete shaft collar at the No. 6 shaft of the Mohawk Mine, in the Lake Superior Copper district described in the JOURNAL of Aug. 10, 1912, was built in 17 days at a total cost of $3931. The length of the collar was 100 feet.

Shaft Timbering in Minnesota Iron Mines

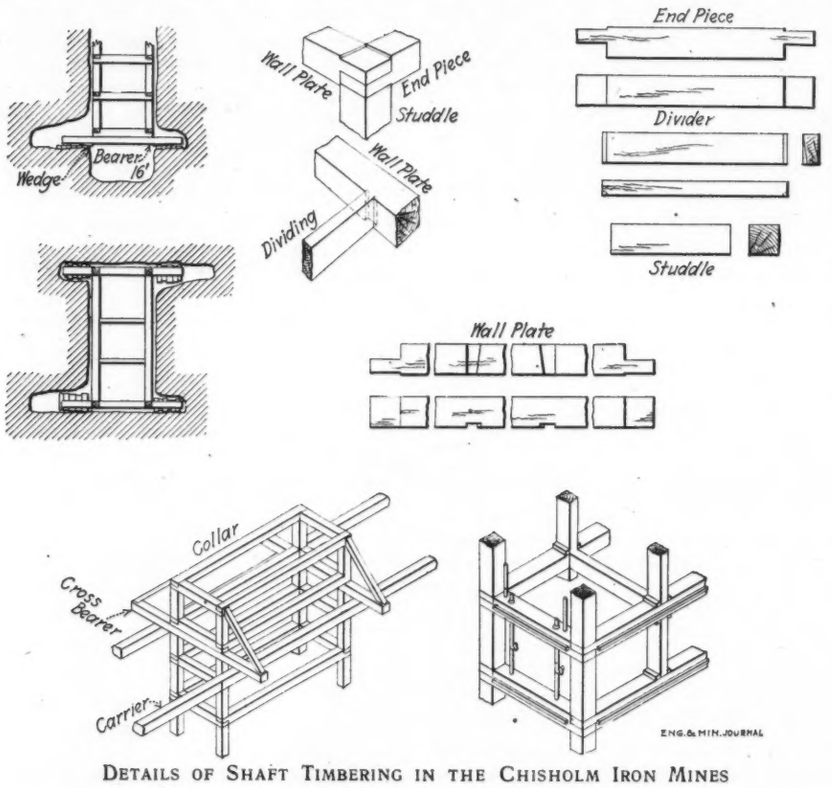
BY L. D. DAVENPORT*

Accompanying are notes and sketches on the timbering of a shaft, 6x18 ft. inside, sunk through surface, sand and ore in the Chisholm district of Minnesota. No water was encountered until the ore was reached and then only a small quantity. The illustrations show the details of timbering.

After the shaft is staked out, two level trenches are dug on surface and two bearing pieces or carriers, 40 or 50 ft. long (2- or 3-ft. flattened timber), are placed in them about 10 ft. apart. These 40-ft. bearing pieces are parallel to the wall plates and when they are leveled up, two cross-carriers 12 by 12 in. by 20ft. are placed perpendicularly across them 18 ft. apart. The first set is then put in place with the end pieces (12 by 12 in. by 8 ft.), resting on the cross-carriers.

The next set is then put in place below the carriers and the studdles of this set fit into ½-in. joggles, which have been cut in the cross-carriers. These studdles are cut off on account of the cross-carriers, so that the distance between the sets is 3 ft. 11 in. The 12x12-in. studdles in the regular sets are 4 ft. long, but since there is a ½-in. joggle in each wall plate and end piece, the distance between the sets is only 3 ft. 11 in.

*Engineer, Oliver Iron Mining Co., Mesaba, Minn.



DETAILS OF SHAFT TIMBERING IN THE CHISHOLM IRON MINES

The first set below the carriers is like the other sets, held by four hanging bolts of 1¼-in. round iron. Next, the set which forms the collar is placed above the set resting on the carriers, and is diagonally braced to both sets of bearers. Four straight hanging bolts are used here instead of the jointed bolts used in the other sets. The bolts for this collar set are made 1 ft. longer than the regular bolts, which are 6 ft. 8 in. long, on account of their passing through the cross-carriers as well as the end pieces. Collar set end pieces rest on top of wall plates. As the dirt is hoisted it is banked around the shaft collar, and serves not only to steady the timber, but also keeps out the surface drainage.

The middle compartment is used for hoisting and is boarded up as fast as the dividers are put in, so that the bucket will not catch. The dividers are put in as the shaft is sunk, but the last two sets are always left open to allow the wall plates of the next set to be handled. When the end pieces and wall plates are framed, a strip 2x2 in. is spiked on the outside of each piece in the center, to make a bearing for the laths.

The laths are 2-in. plank about 4 ft. 9 in. long and are put in at the corner studdles first and wedged, and then working toward the middle of the end pieces, and wall plates, until there is space for only one lath left. This last lath is fitted to the space and then it is shoved up by the 2x2-in. piece on the upper set, and then pulled down (with a pick) until it bears on the 2x2-in. piece of the lower

set, blocking having been placed behind it to hold it in position. Four hanging bolts to each set is usually enough, but in heavy ground one or two more are sometimes used in the wall plates. Divider studdles or center studdles, 6 by 12 in. by 3 ft. 11 in., are put in after the dividers are in, and since these studdles are not "gained in" to the wall plates, small cleats are used to hold them in place.

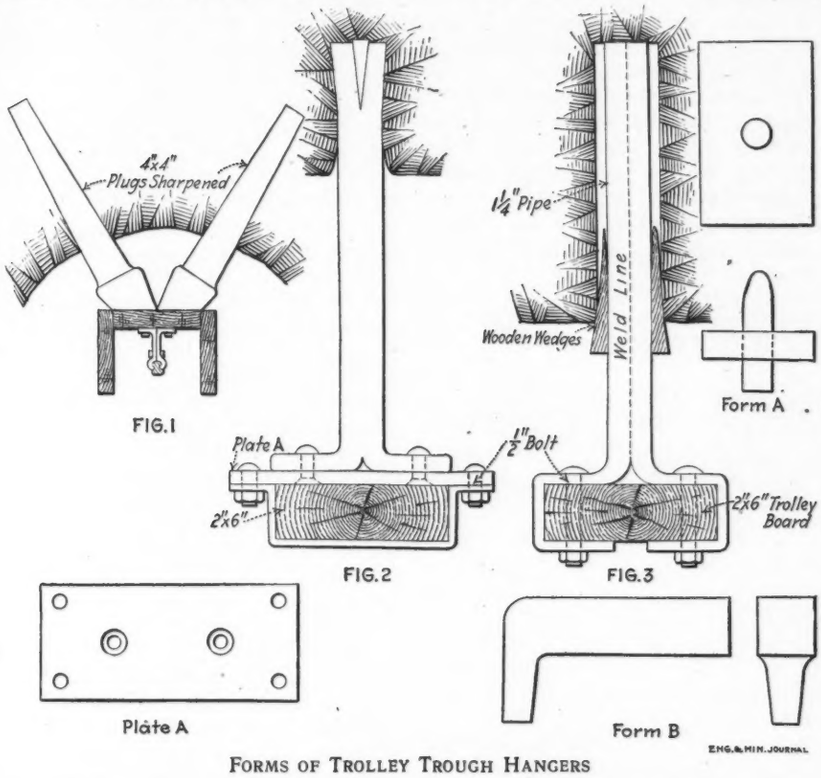
The second set of carriers are 12x12-in. timber 16 ft. long, and to put them in place, small drifts, about 3x4 ft., are run in about 8 ft. at the end of the end pieces at two diagonally opposite corners of the shaft. Smaller drifts are run in about 4 ft. at the other two corners of the shaft. The inside corners of these 8-ft. drifts are rounded off, and the bottoms trued up, and short pieces of plank laid crossways in them. A bearer is then brought down and one end is run into the 8-ft. drift. Next it is swung parallel to the end piece and the other end is run back into the 4-ft. drift. The same thing is done with the other bearer and the two rest on the bottom boards of the drifts, directly under the corresponding end pieces. Long, flat wedges are then driven under the bearers on top of the boards and as they are raised against the end pieces, the hanging bolts are tightened to take up the weight. When the bearers are up tight against the set and well wedged, the small drifts are carefully blocked up and the laths put in. The shaft is continued until the bottom rock is reached. The last set is then caught up with short posts placed close together under the end pieces and wall plates.

Hanging Troughs for Protecting Trolley Wires

By Claude T. Rice

Contact with live wires underground is liable to be followed by more serious results than at the surface. The miner's clothes, shoes and the ground on which he stands are generally damp, consequently from the same circuit he takes off more current than would be possible under ordinary surface conditions. At Bisbee, men have been killed by contact with 230-volt alternating-current, as well as with 220-volt direct-current circuits. The amperage in both cases was high as the wires were on the power line. On investigation, doctors attributed both deaths to weak hearts and susceptibility to electric shock. In Missouri a miner was killed by grasping one of the wires of a three-phase, 220-volt, alternating, power circuit. He was showing a man who was warning him of the danger that the wires were perfectly harmless. In this case it was surmised that a ground from the wire of the other phase existed nearby so that the miner really got 440 volts.

It is of the utmost importance that miners realize the danger, underground, of these high-amperage circuits, for men have and are being killed by wires carrying only 220 or 230 volts. To guard against such accidents some form of trolley-wire protection is necessary. This usually takes the form of a trough, the sides of which extend down below the wire and keep men from hitting the wire with their bodies or with tools they may be carrying on their backs. At chutes the danger is especially great, but it costs little more and makes the workings far safer to extend the trough protection throughout the mine.



Forms of Trolley Trough Hangers

Three different methods for supporting the protecting trough have been suggested. The cheapest is probably a modification of the system used to carry the insulators at the Mascotte tunnel, Bingham, Utah. Here stoping drills put two inclined holes into the adit roof, 12 in. deep and 2½ in. in diameter; 4x4-in. pegs sharpened to fit are driven into the holes. As these two pegs slope away from each other, the trolley trough would be securely held to the roof if it were nailed directly to their squared heads, as shown in the accompanying drawing, Fig. 1. This method is practicable when the roof is of uniform height, so that long plugs are not necessary to keep the trolley board approximately level.

A better method adaptable to all roofs is that used at some of the mines of the Cleveland-Cliffs Iron Co. in the Lake Superior district. Here steel pins are fastened in vertical holes by a wedge driven into the split inner end of the pin, as seen by the accompanying drawing, Fig. 2. The outer end of the pin is also split and bent out to form wings. These wings are flattened and to them is riveted a ½-in. plate carrying four holes through which pass ½-in. carriage bolts which support the straps carrying the protecting trough. The plate is made wide enough for four bolts to allow the troughs to be spliced at the pins. It is just as well, however, to splice the troughs with top or side cleats and so have the wings carry the straps directly without the intervening plate. This makes a strong hanger where the trough has to be carried at some distance from the roof, and it is a good way to use up old drill steel.

At the Cliff shaft of the Cleveland-Cliffs company a somewhat less expensive hanger has been devised by Lucien Eaton, superintendent of the Ishpeming mines of this company. Pieces of 1¼-in. pipe are fastened by wooden wedges in holes in the roof 10 in. deep as shown by the accompanying sketch, Fig. 3. The outer end of the pipe is split, one cut following the weld. This end is then spread out and the wings flattened on forms. The first form consists of a flat piece of iron 1 in. thick, 4 in. wide and 6½ in. long. A pin at the center of the form projects both top and bottom; the top end enters and centers the pipe, while the bottom end is shaped to enter the hardie hole of the anvil and hold the form. The wings of the pipe having been bent down and flattened are bent at right angles over the ends of the form. The pipe with the wings still hot is now completed on the second form. This is merely a 2x2-in. bar of iron with its end

bent down and shaped to enter the hardie hole. On this form another right-angle bend, back toward the center of the hanger, is made in each wing.

In this way a 6½x2-in. yoke is formed to receive the top board of the trolley trough. The yoke is bored for two ½-in. bolts, one on each side, by which the 2x6-in. trolley boards are securely fastened. With this system the trolley boards are spliced by the side boards of the trough or by a top cleat. By the use of forms a uniform size and shape of hanger is insured and much time is saved in the blacksmith shop. A good blacksmith can easily make ten hangers per hour. As all scrap pipe and short lengths that are in a fair condition can be utilized, the hangers are relatively cheap and, unless unduly long, are quite strong enough. Measurements are taken at the different points along the drift and the hangers, properly numbered, are made and sent down ready to be put 10 in. into the plug holes and yet bring the trolley board level, so that the trolley will run at approximately the same height throughout the mine, as is desirable for the best operation.

Aside from the advantage derived from the use of the protecting troughs from the standpoint of safety the top board of the trough acts as a guide to the trolley pole should it jump the wire, and thus saves it from injury. The Cleveland-Cliffs company, while it does not use a trough along the entire line, does use a top board, to carry the insulators. Troughs are used only where there is much travel, and near chutes.

Compressed Air Meter

A meter for compressed air is on the market under the name of the Excelsior Airometer. It consists of a series of small fans or turbine wheels alternating with stationary guide-vane rings, the whole being inclosed in a cylindrical casing. The record dials are graduated to read cubic feet of free air. The capacities of the dials range from 10,000,000 cu.ft. on the smallest size to 100,000,000 on the largest.

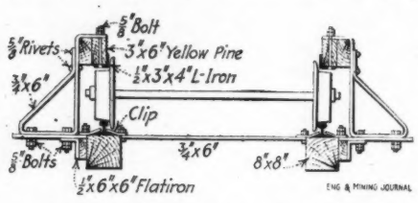
Provision is made for throwing the recording dials in or out of gear so that the airometer may be used for tests of the air consumption of pneumatic tools. This feature will be useful in determining the effectiveness of repairs on pneumatic tools before sending them out from the repair shop.

The airometer is built in eight sizes with capacities of from 125 to 10,000 cu.ft. of free air per minute. It is claimed that the accuracy of the device is not affected by the pressure and that it can be used for pressures of from 50 to 150 lb. per sq.in. The airometer is manufactured by the Excelsior Drill and Manufacturing Company, Empire Building, Denver, Colo.

Track Spreader and Guard Rail Bracket

The type of track spreader shown is particularly useful to keep the rails to gage on timber stringers which have become partially rotten, so that they will not hold a spike securely. Of course, the surest remedy is to replace the stringers, but often the use of a track spreader will keep the skipways in commission until holidays, when stringers can be replaced without interrupting the mine output.

A ¾x6-in. flat iron, bored for ½x2½ x4-in. clips, is driven under both rails after sufficient rotten timber has been cut away, as seen in the accompanying illustration. The clips are then bolted to the flat iron. This will keep the track to gage, even though the rails may move to the sides of the stringers. To keep the rails centered on the timber, ½x6x6-in. clips may be bolted to the bottom of the spreader and wood blocks can be driven between the clip and the stringer, the stringers being kept the proper distance apart by the usual 3x6-in. spreader held by a girt rod. To save the cable, rollers are used near the iron spreaders.



TRACK SPREADER AND GUARD RAIL BRACKET

Brackets of ¾x6-in. flat iron, to hold the back or guard rail, may be bolted to the projecting ends of the track spreader. The same type of bracket on new skipways is made longer by an amount equal to the depth of the stringer, and bolted to the wall plates, which are usually introduced at 15-ft. intervals.

Laying Up a Boiler

When a boiler is to be out of commission for some time, the following procedure is recommended in *Power* to prevent rusting.

Wash out the boiler with clean water, disconnect the feed-water pipe and after draining off the water remove the safety valve or a manhole on top of the boiler. Then, with a very light fire drive out all moisture and close the boiler up tight. All flues and smoke connections should be thoroughly cleaned, the smoke uptake should be disconnected from the stack and the boiler flues, smoke flues and stack connection should be stopped up to prevent circulation of air from depositing moisture.

Neutralizing Blasting Fumes

BY W. H. MAWDSLEY*

Although the use of compressed air is an efficient way of removing the fumes caused by blasting, and incidentally, other impurities in the air, it only disperses them and, moreover, is not always available. The sulphur fumes, caused by the ignition of pyritic ore in blasting, are in some mines exceptionally severe; in such cases the charges are usually fired only at intervals when work in other parts of the mine has ceased. Doctor Mann states in his report on the gases produced by explosives in mines in West Australia, that there is no means of preventing the sulphur fumes.

A simple and effective way of overcoming this difficulty is by the use of suitable chemicals as tamping. The alkaline hydrates give the desired results and also absorb some of the CO_2; the addition of an oxidizing agent in the tamping converts the CO into CO_2 which can then be absorbed. With regard to sulphur fumes, moist slaked lime has proved invariably effective. A small quantity is placed at the bottom of the hole and more is used on top of the charge in place of the usual clay "cocks." At the instant of explosion the hydrate comes in contact with the nascent gases and immediately absorbs them. Another method is first to pour a little water into the hole and then add some soluble hydrate (such as barium or strontium) which is dissolved in the water; the charge is now introduced, the solution being thus mixed in with the explosive. A further quantity of hydrate is used above the charge in place of the ordinary tamping. The material is made into suitable sized cartridges covered with as little paper or organic matter as possible. This tamping is a convenience to the miner, and by preventing the sulphur fumes, makes blasting in pyritic ore possible at all times. By the addition of an oxidizing agent, the carbon monoxide given off by some explosives is to a large extent rendered innocuous.

Hammer Drills at Premier

JOHANNESBURG CORRESPONDENCE

One hundred Flottman hammer drills, installed at the Premier mine, are expected to save £4000 per month over the cost of native drillers. In drilling down holes in the blue kimberlite, one machine drilled 31 holes 6½ ft. deep in two hours. In actual work run by natives in three drilling shifts of six hours each, three machines drilled 1000 ft. The machines are of the "plugger" type, being held in the hand. The valve is an oscillating ball thrown over by compression at the end of the stroke. The drills weigh 25 lb., and use 25 cu.ft. of air per minute.

*Mt. Morgan, Queensland.

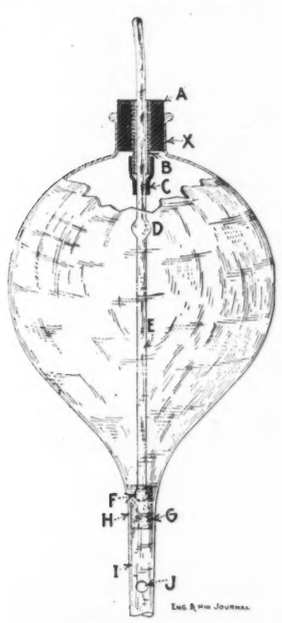
Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Automatic Filter Feed

The accompanying diagram shows a device of T. A. Mitchell (*Journ. Ind. Eng. Chem.*, Aug., 1912), for automatically supplying solution to any laboratory filtering medium where a quantity of liquor, or wash water, is required to be filtered. The apparatus is especially serviceable where it is desired to filter over night.

The main body consists of a pear-shaped funnel of the separatory type, minus the glass stopcock. The neck *X* is of such size as will take a No. 3 rubber stopper. The outlet *I* is 6 cm. long and 1 cm. inside diameter, being



AUTOMATIC FILTER FEED

slightly enlarged at *H* to engage the No. 00 rubber stopper *G*, which is attached, as shown, to the glass rod *E* at *F*. This glass rod should be of a diameter that will pass freely through the 5-mm. glass tube *B*. A nodule is formed at *D* by heating.

The upper portion consists of a No. 3 rubber stopper *A*, a glass tube *B*, 3 cm. long and 5 mm. inside diameter, and a piece of $\frac{3}{16}$-in. pure-rubber tubing *C*, 15 mm. long. The hole *J* should be about 4 mm. in diameter and determines the level of the liquor in the filtering apparatus below.

In use, the glass rod *E*, with stopper *G* attached, is passed through at *X* and the stopper *G* inserted at *H*. The liquor to be filtered is poured in through *X*, using the protruding glass rod as a guide for the solution, if it be so desired. After the solution has been added, the parts *A*, *B* and *C* assembled as a unit, are slipped over the upper end of the glass rod and the rubber stopper *A* made tight at *X*.

By quickly lifting the glass rod the nodule *D* will enter the protruding rubber tube *C*, resulting in an airtight joint at *C* and a free passage at *H*. The amount of liquor passing through *H* is regulated by the volume of air which enters through the trap *J*. The hole *J* is not absolutely essential, but we find it does away with considerable upward suction of the liquor below, thus assuring a better washing of the residues in cases where that is the desired result. With *E-G* in position the nodule *D* should be about 3 cm. below the tubing *C*.

Hexagonal Trommel for Fine Pulp

After the mill of the Desloge Consolidated Lead Co., in southeastern Missouri, had been remodeled to replace the Harz jigs with Hancock machines, it was found that the fall, in which the fine screening had to be done, was small. The undersize from the 10-mm. trommel was to be passed over a 1-mm. screen to divide it into table and jig feed. A hexagonal trommel had been used in the old mill for fine screening, but it was decided to experiment with a conical trommel to see if better results could not be obtained.

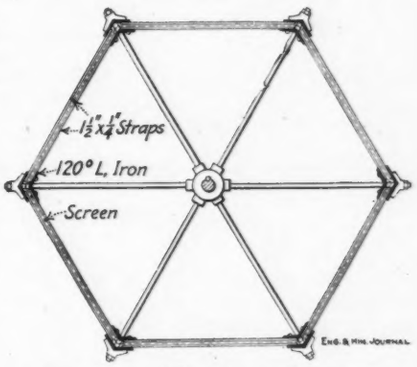
The conical trommel was 96 in. long with diameters of 36 and 48 in. Four interior rings $\frac{5}{8}$ in. thick and $2\frac{1}{2}$ in. wide carried the screen, which was set with a fall of $\frac{3}{4}$ in. to the foot. Each ring was stiffened with six spokes. The speed of the trommel was 20 revolutions per minute.

The hexagonal trommel was 96 in. long and the circumscribing circles had diameters of 36 and 48 in. There were four hubs on the carrying shaft, from each of which six spokes radiated. Longitudinal, 120° angles, fastened to one spoke of each of the four sets, formed the corners of the hexagon and to these angles were fastened the screen plates. The six screen plates had no internal support other than the angles, except at the ends of the trommel, where $1\frac{1}{2}$x$1\frac{1}{4}$-in. straps encircled the screen inside and out to stiffen its edges, as seen in the accompanying drawing. The hexagonal and conical trommels were operated at the same speed, 20 r.p.m. There was a 14-in. fall when the pulp dropped from one face of the hexagon to the other.

The screen used on both trommels had 1 mm. round holes, staggered $2\frac{1}{2}$-mm. centers, punched in No. 22 gage steel plates. An outside spray helped to prevent binding in both cases. The character of the rock and the scouring and pounding action of the large volume of oversize prevented much trouble from binding. Both trommels were fed at the rate of 150 tons per 24 hours.

The tests were carried on for several weeks, so that they show average conditions, and all conditions were as near the same for both trommels as it was possible to keep them, regarding feed, water, speed, etc. The results of the tests are as follows: Oversize finer than 1 mm.; conical trommel, 7.02%; hexagonal trommel, 4.77%; life of jacket, conical trommel, 7.1 days, 1065 tons; hexagonal trommel, 12.85 days, 1927 tons.

The reason for less binding and thus less undersize in the discharge from the



SECTION OF HEXAGONAL TROMMEL

hexagonal screen is accounted for by the greater agitation which the pulp gets in this screen.

The greater life of the screen on the hexagonal trommel is due to the obstructions which the interior rings of the conical trommel offered to the passage of the pulp. This slight obstruction with the low slope used and the greater weight of pulp that accumulated just above the rings resulted in the screens giving away at those points, generally before they were nearly worn out at others. When the interior rings of the conical trommel were made thinner, the life of the screen was increased, but the life of the trommel itself was considerably shortened.

The life of a fine screen depends on the load which it is carrying, for with

the load the friction increases. Owing to the obstruction that the interior rings offer to the flow of the pulp, the load on the conical screen was much heavier than was necessary to pass the same feed through the hexagonal one. It is also well to note that the whole support to a trommel screen should be against outward movement, owing to centrifugal force, rather than against inward distortion. Thus it seems that, for fine screening, the middle and bottom rows of spokes of a conical trommel should have only capping segments to grip firmly and support the screens for a few inches on the inside.

The great advantage of a polygonal trommel for fine screening is that the surface is in sections. It is difficult to patch a hole in a fine screen and with the conical trommel the whole screen has to be discarded. With a hexagonal or octagonal screen, on the other hand, one section is replaced at a time. When the screens are attached between angle ribs rather than on a frame, the labor and cost of changing is also much reduced.

The swish of the pulp that results from the greater lift in the polygonal-shaped screens causes the ore to be passed more rapidly and results in a cleaner discharge than can be obtained with the conical trommel. When the fall that can be allowed in screening is limited, the greater speed at which the pulp will pass through a hexagonal screen, as compared with a conical one, may be the determining factor.

Method for Handling Tube Mill Pebbles

A simple and convenient method for putting the regular daily quantity of pebbles into the tube mill has been devised for the new Nipissing mill at Cobalt. By this method the pebbles are brought in cars to a convenient point back of and above the tube mills. From this point a wooden launder is laid which reaches to the tube mills and terminates directly over the spiral scoop feeder. A hole is cut in the bottom of the launder at this point, and pebbles can be dropped through this hole into the feeder at the moment when the opening of the feeder is coming up under the launder.

This system is believed to be simpler than any yet suggested and avoids carrying and lifting the pebbles directly into the mill and also avoids the nuisance of having pebbles piled up around the mill, a condition which usually obtains when the pebbles have to be lifted into the mill, either at the feed or discharge point.

Pebbles placed in the launder, roll by gravity down to the point over feeders and here they are controlled by the operator who feeds them into the mill at the proper moments when the feeder opening can receive them.

Muffle Annealing Furnace

By Donald M. Liddell*

In a recent trip through a large metallurgical plant, I was much struck by the working of a water-sealed muffle-type annealing furnace (patented), used for copper wire. The muffle itself was made of several cast-iron sections, bolted together. The end sections slanted down and ended under water. The copper was carried through the furnace on a double endless-chain belt, and the time the copper remained in the furnace was determined by the speed at which this belt moved.

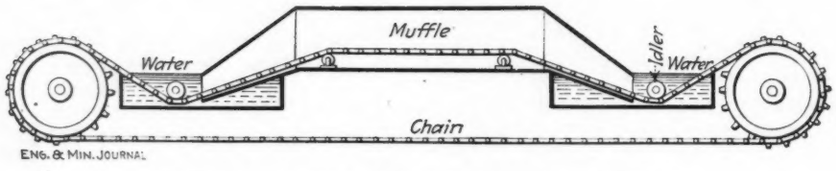
Control of the temperature was by means of a recording thermo-electric pyrometer. The muffle was coal-fired, and the attendant, who watched several muffles was allowed a range of 100°, from 1000° to 1100° F. There was apparently no difficulty whatever in holding this range of temperature. Indeed, during about 25 min. I did not observe a swing as great as 10° Fahrenheit.

I was told that no special precautions were necessary when the fire was allowed to go out, to prevent the muffles from filling with water. This would apparently argue that either the bolted joints or the pyrometer holes were not tight, although it was said they were intended to be so. At any rate the leakage of air was not sufficient to tarnish the copper, which came out as bright as when it went in. This is, until the trade becomes educated, one of the objections to the furnace, as lots of wire are occasionally returned to the works, the consignees alleging that the wire is so bright that it cannot have been annealed.

So far as possible the furnaces are kept under fire constantly, as it has been found that it is cheaper to burn coal than to pay the repairs due to too frequently cooling and heating the cast-iron muffles.

The travel of the chain is around the main driving sprocket, down on a slant into the water, under an idler, up an incline through the first section of the furnace, along the level through that part of the muffle directly heated (this section is, of course, above water level), down into the water, under another idler, up over the other large sprocket, and back underneath the furnace.

There are two sets of sprockets and of idlers, and two chains running over them. Iron bars are fixed at intervals running between the two chains, and sheets of copper are laid between these bars. The rolls of wire are then placed on top of the sheets, and go through the furnace in that manner. The illustration is intended only to be diagrammatic and should not be regarded as a working drawing.

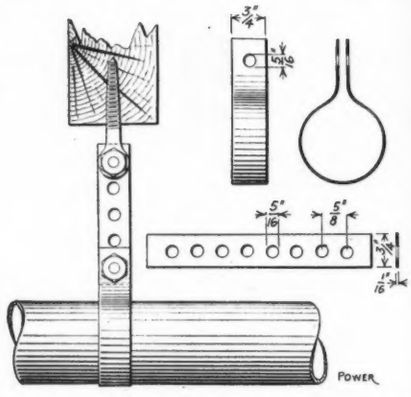


Diagrammatic View, Muffle Annealing Furnace

*Associate editor, Engineering and Mining Journal.

Hanger for Light Pipe

The accompanying illustration shows the general details of a convenient pipe hanger for supporting light pipe, from 1 in. up to 3 in. in diameter. It is made up of a V-shaped ¾-in. band-iron 1/16 in. thick, and bent so that the inside diameter is the same as the outside diameter of the pipe it is to support. The flat ends of this piece are punched with 5/16-in. holes, says H. M. Nichols (*Power*, Oct. 22, 1912)



Hanger for Light-weight Pipe Lines

The second part of the hanger is a flat strip of band-iron in which a number of 5/16-in. holes have been punched about ⅝ in. apart. The strips can be made up in random lengths and when used broken off to the desired length.

Eye lagscrews are used to fasten the pipe hangers to the ceiling. These lagscrews are most easily put up before the pipe is put in place. The bands can be put on the pipe and clamped loosely to the straight strips with ¼-in. bolts. After the pipe is lifted into place it is only necessary to bolt the straight strips to the lag-screws with ¼-in. bolts. This type of pipe hanger is particularly convenient when it is necessary to run a line of pipe on a slant.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Thoria Recovery

A means of preparing pure thoria by phosphorous acid is given in by F. Wirth (*Zeit. f. Angew. Chem.*, p. 1678, 1912). A cold saturated solution of disodium phosphite, $Na_2HPO_3,3H_2O$, is added, drop by drop, with stirring, to a boiling solution of thorium and trivalent earth metals (e.g., that obtained by the decomposition of monazite sand), which should contain 15 to 20% of free sulphuric acid, and, after some hours, the flocculent precipitate of thorium phosphite, which at once separates, is brought on to a hardened filter, washed with water containing sulphuric acid, rinsed into a dish, dried on the water-bath, and oxidized by treating with 20 c.c. each of fuming nitric acid and concentrated sulphuric acid (for 0.2 to 0.25 grams of precipitate); the nitric acid is then completely removed by evaporation, the mixture of sulphate and phosphate dissolved in 800 c.c. of water, and the thorium separated by adding excess of oxalic acid to the cold solution. The phosphite precipitate may also be decomposed by prolonged boiling with potassium-hydroxide solution, the hydroxide precipitate being dissolved in dilute hydrochloric acid and the solution precipitated by oxalic acid.

Stage Charging in Openhearth Process

F. W. Paul, of Glasgow, before the Iron and Steel Institute, under the title "Manufacture of Openhearth Steel with Reference to Improvement in Yield," stated that he had obtained yields much nearer the theoretical amounts by charging about 10% of the required pig iron, melting it, thereafter charging the remainder of the pig iron into the molten bath, which is kept liquid substantially during the entire period of charging.

After the pig iron is all charged and the silicon sufficiently reduced to allow superheating the metal without loss, the steel scrap is charged at the maximum rate at which bath can be kept liquid. The method of dealing with fractions of the charge, with equivalent portions of iron oxide, allows the elimination of the silicon at a low temperature, and so avoids fluxing of the banks, thus affording, in the basic process especially, means of working with low-sulphur pig iron, and greater latitude as regards silicon content.

The pig is desiliconized by the iron ore at a low temperature without loss of carbon, or volatilization of iron as brown oxide, and the recovery is raised by 5 to 7%. The brickwork of the furnace is not subjected to extreme fluctuations in temperature. The free unobstructed passage of the flame is not so destructive to linings and roof as when the flame is deflected by striking against piled-up material in the furnace. There is less scouring and fluxing of the furnace banks, and consequently the furnace needs less repairs. Owing to the much decreased loss of iron as oxide, there is less cleaning of the gas and air chambers required, and owing to diminished fluxing action, because of the lessened deposit in them, they will last about twice as long as with ordinary working. The process has been tried out on a 70-ton furnace.

Hybinette Copper Extraction Process

The following process for the extraction of copper from sulphide ores is given by N. V. Hybinette in French pat. No. 440,712. The ores are roasted with from 2 to 20% of sodium sulphate, and then leached with dilute sulphuric acid.

If desired, a preliminary extraction with water is given to the roasted mass in order to avoid the solution of iron. The solution, which contains the sulphates of sodium, copper, iron, and possibly of nickel and zinc, is then subjected to electrolysis with insoluble anodes. The acid electrolyte is used for successive leachings until too strongly charged with sulphates. It is then used instead of fresh quantities of sodium sulphate to add to the charges of ore before roasting. The loss of sodium sulphate is thus small, and is made up by the addition of common salt. When the concentration of zinc and nickel becomes sufficiently great, these metals are separated either by electrolysis or by precipitating with soda or lime.

Erkens' Aluminum Solder

Charles R. Erkens, of New York, has patented (U. S. pat. No. 1,033,565) an aluminum solder which he claims can be used with an ordinary soldering iron. He melts block tin, 60 parts; zinc, 15; lead, 10; antimony, 5; bismuth, 5; chromium, 5 parts, and when melted and thoroughly mixed cleans the melt by introducing (preferably) 35 grams of salicylic acid and 10 grams of calcium for each five pounds of alloy, although other acids and oxidizers will perform the same function. Afterward he throws on about two grams of sulphur to facilitate removal of the dross.

A small amount of the oxidizing and cleansing agents (about 5%) will be retained by the alloy and take the place of the acid or flux used in ordinary soldering processes. [Calcium and salicylic acid are not usually considered oxidizing agents. We merely quote from the patent.—EDITOR.]

Heavy Electrolytic Nickel Deposits

The question of obtaining thick deposits of nickel has been investigated recently by A. Holland, of Paris (*Bull.* Soc. d'Encouragement pour l'Ind. Nat., July, 1912). The difficulty in getting thick deposits seems to lie in the evolution of hydrogen at the cathode, so his endeavors have been along two lines: to oxidize the hydrogen as set free; to prevent its formation. The best baths found along the first lines were: (1) Crystallized nickel sulphate, 45 grams; ammonium chloride, 10 grams; sodium persulphate, 5 grams; water to make up to 400 c.c. Or, (2) Crystallized nickel sulphate, 40 grams; crystallized magnesium sulphate, 40 grams; boric acid, 7 grams; sodium persulphate, 5 grams; water to make up to 400 c.c. Or, (3) Crystallized sulphate of nickel, 40 grams; crystallized magnesium chloride, 40 grams; boric acid, 6 grams; water to make up to 400 c.c. There was no gas evolved with this last bath, using a 0.3 amp. current on a 42-sq.cm. cathode and anode, in spite of its lack of oxidizers.

However, by far the best results were obtained with nickel-fluoborate solutions. The natural idea is that boric acid can be dissolved in hydrofluoric acid, and the mixture neutralized with nickel carbonate. However, the preparation of the best bath possible is by no means a simple matter. To make up two liters of solution, take 350 grams of sodium carbonate in one liter of water, and pour it warm into a lukewarm solution of 600 grams of nickel sulphate in 5.5 liters of water, and stir well. The precipitate must be washed by decantation, stirring up well after each addition of water, until there is no longer any sulphate-of-soda reaction with barium chloride. This washed nickel carbonate must then be dissolved while fresh.

Mix 250 grams of boiling water with 130 grams of boric acid, cool, and add to it, while stirring, 285 grams of 43 to 46% commercial hydrofluoric acid, a little at a time. Then add the carbonate of nickel. When no more gas is given off, stir until there is a homogeneous milk of nickel carbonate left. These operations cannot be performed in glass, but after this point it may be put in glass and should be introduced into a laboratory shaker, where it should be shaken for 20 hours. Filter and wash to make up to two liters.

Even this carefully prepared bath often requires electrolyzing with a cast nickel anode for three or four days to get the best results in cammercial plating.

The St. Helens Mining District

The St. Helens mining district in Washington was described by Horace G. Winchell, in a paper read at the Cleveland meeting of the American Institute of Mining Engineers.

To the inexperienced prospector, who cannot tell specular hematite from galena, or gray copper from a mixture of pyrite and arsenopyrite, it would probably be attractive, and as a result of weeks and months of labor he could procure an occasional specimen for exhibition or assay. But the prospector of experience would notice that there are no placer deposits, that there is a universal absence of quartz in vein matter and float, that there is no gossan or iron hat.

There is no increase of mineralization at depth, there is no ore in commercial quantity, there is no softening and alteration of the country rock adjacent to joints and seams, such as would exist in the neighborhood of mineral deposits. The joints are associated with and enlarged by deposits of epidote, tourmaline and magnetite. Tourmaline is a pneumatolytic mineral, and must have been deposited before the rocks were cold, and before vein solutions could exist, and pneumatolytic copper deposits are rarely big enough to make good copper mines.

In short, Mr. Winchell's verdict is overwhelmingly unfavorable to this district, the genesis of which is described as follows: "From the enthusiasm born of ignorance, and solely through the reports and specimens of two German farmers, the prospecting fever spread so rapidly that within three years there were 500 men in the district, and locations were made without number. The proprietors of a German newspaper in Milwaukee became interested. They furnished the capital; and under the advice of their expert, who was naturally one of the discoverers of the district, spent many thousands of dollars in prospecting work. Mining companies of large capitalization were organized and stock sold broadcast. Thousands of feet of tunnel were driven for the purpose of penetrating and exposing to view the enormous bodies of ores—supposed to be demonstrated by the tourmaline seams on the surface. The developments were not altogether satisfactory even to the dream-blinded journalists, and they finally concluded to take a moderate price by selling for a few paltry millions to an English syndicate. Then came the first inspection of the district by a man of some knowledge, and a report which suddenly stopped the expenditure of money."

Gold in the Texas Eocene Deposits

At the Cleveland meeting of the American Institute of Mining Engineers, E. T. Dumble reported on work he had done on reported discoveries of gold in the Texas Eocene deposits. Several years ago specimens were sent him alleged to have been concentrated by a rocker from the sands of Gazley Creek, a stream which empties into the Colorado River just north of Smithville. On personal investigation he found no samples giving over a trace of gold by fire assay, and obtained colors in only a few pannings.

Near Harwood on the Gonzales branch of the Galveston, Houston & San Antonio Ry., various wells disclosed a stratum of argilaceous sand carrying glauconitic matter and pyrite which showed gold on assay. One well, in which samples were taken every foot for 38 ft., gave 32 samples carrying 16c. to $8 per ton. The geological relations here are the same as at Gazley Creek, and all are connected with the Lignitic stage of the Eocene.

The composition of the beds suggests the granite area of the Llano region as the origin. Gold and silver are known to occur in the porphyries and micaceous schists of the Llano region, and gold is found in the sands of the creeks flowing over or through these rocks. Placer gold has been found in the Big Sandy, and in the sands of the Colorado as far south as Austin. The nature of the occurrence is judged by Mr. Dumble to warrant further investigation.

Nickel Extraction in Norway

Although there are many deposits of nickel in Norway carrying about 2% Ni, they were incapable, for many years, of competing with the rich ores of Canada, says *Metaux et Alliages*, and during the closing years of the nineteenth century the annual Norwegian production did not exceed seven tons.

Since 1900, however, the industry has revived, and in 1909, the Evje works treated 5770 metric tons of ore, carrying 1.1% Ni. Each 100 tons of ore gave 2.77 tons of matte, carrying about 40% Ni and 25% Cu. This matte is refined at the Christiansand electrolytic refinery.

The matte is said to be used as anode in a feebly acid solution, from which pure copper is deposited. When the nickel in the bath reaches a certain limit, the current is cut off, and the small amount of copper remaining is thrown out by sulphuretted hydrogen. The iron is also precipitated at this point, but no information is given as to how this is done. The nickel solution is then heated and nickel deposited, using insoluble anodes. The current consumption is said to be large, so that the success of the process depends on a cheap supply of power, such as is to be had in Norway.

Precipitation of Carbon in Copper Analysis

The use of various organic "dopes" has long been recommended in copper analysis by electrolysis, in order to produce good deposits. Although it has been known that carbon could be coprecipitated with nickel and iron by electrolysis, it has always been thought that carbon was not precipitated with copper.

However, in a paper before the International Congress of Applied Chemistry, Messrs. Spear, Chow and Chesley claim that carbon has been found by them in the deposit obtained from electrolyzing a copper-sulphate solution containing a little nitric acid and small amounts of gelatin (*Proc.* vol. XXI, p. 93).

It was more difficult to obtain carbonaceous deposits with stationary than with rotating electrodes. Carbon is only thrown down when nitrous or nitric acid is present in the electrolyte. Reducing agents prevent its deposition. The paper apparently shows a hitherto unsuspected possibility of error in electrolytic analysis.

Purification of Zinc Solutions

It is suggested by Edouard Flügger (*Revue des Prod. Chim.*, July 10, 1912), that alkaline-zincate solutions can be purified by boiling zinc dust with these solutions. This will throw down all other metals than zinc as a flocculent precipitate, and the purified solution can then be precipitated by hydrogen sulphide for the production of an absolutely white zinc sulphide. The zincate solutions should be concentrated, only about one part of water per part of alkaline hydroxide, they should be boiling, and the boiling should only be continued until a flocculent precipitate is formed.

Improved Mercury Cathode

The use of the mercury cathode for electrolytic analysis has been attended by the disadvantage that the mercury did not wet the containers and a film of electrolyte was trapped under the cathode. It is said in the JOURNAL of *Physical Chemistry* that this can be avoided by using a platinum dish previously plated with mercury deposited from a cyanide electrolyte.

Cyanidation in the Cobalt District

By Herbert A. Megraw

Rich silver ores are treated by cyanidation. The treatment offers many problems comparatively new to cyanidation. The ores are picked, jigged and concentrated and the tailings cyanided. The Nipissing new mill will dispense with concentration. Agitation is performed generally in Pachuca tanks, though some mills use tanks with flat bottoms and mechanical agitators. Zinc-dust precipitation is favored. Vacuum filters are used, though not well adapted to the heavy granular nature of the ore. The metallurgy is not settled and developments may be expected.

The mining district of Cobalt in Ontario, Canada, is one of the newer areas in which economic mining has proved possible. In common with most new camps the first output was high-grade material, but it differs from many in the fact that the average content of the mineral has continued up to this time to be higher than is usually the case when work has been carried to the extent that it has here. The valuable metal is silver which occurs native and in combination. It is found as sulphide, arsenide, antimonide and in combination with manganese, nickel and cobalt. Small proportions of copper are also found in some of the ores and in at least one, the Nipissing, mercury has been definitely proved to exist. In regard to the latter many engineers are skeptical, having never encountered any indications of it even in the higher grade mineral but the work of the metallurgists who experimented upon the ores of the Nipissing mine has been sufficient for them to state positively that a small quantity of mercury does exist as a mercury-silver amalgam.

Ores Hard and Tough

The ores occur in narrow fissures in a country rock of fine grained conglomerate, slate or diabase. They are all hard and tough and are not easily ground to a fine state. The experience of the camp has been that when the ores are ground extremely fine, even to a point where they will pass a 200-mesh screen, the product is largely granular and has the property of settling quickly, the light, flocculent product generally called true slime being conspicuous for its rarity. In addition to this, the mineral is extremely heavy, so that the difficulty of obtaining a product which may be treated as a total slime is greater than is usually the case with silver ores. The power and care required to keep it in suspension is comparatively great.

Most of the mills in the Cobalt camp are concentrators and due to the character of the mineral, which is favorable to concentration, good results have been obtained from this system of treatment. The silver occurs, as has been mentioned, in heavy minerals which give up a large percentage of their silver content on the concentrating table. Nevertheless, the tailing discarded by the concentrating mills contains sufficient silver so that its extraction, or partial extraction, by cyanidation while the pulp is in motion through the mill, might be expected to repay more than the additional expense of cyanide treatment. It is altogether likely that the average tailing from a concentrator treating 25- to 35-oz. ore will contain not less than five to eight ounces of silver per ton. Most of the operators will not admit that the tailing runs so high, but a consideration of the conditions, together with some frank conversation with operators leads me to believe that these figures do not overstate the case.

If this is true, then cyanide treatment of the table tailing should be economical in view of the fact that most of the work has already been done on the ore and the additional cost of regrinding plus the cost of chemicals and labor would be more than met by the additional silver recovered. I have already said that the ore, even when finely ground, is difficult to agitate, but this does not conflict with the idea that cyanidation would be economical, because it is conceivable that the fine sand might be leached at a cost which would be less than that of agitating them. I am unable to discover that any exhaustive experiments have been carried out on leaching a concentrate tailing, but I do not know of any good reason why it would not be possible, particularly in those mills where concentration has already been installed. It may be true that a new mill designed for cyaniding the entire product would give the most economical result eventually, but that is no reason why mills now operating as concentrators could not increase their profits by cyaniding the table tailing in some way. The analysis of the ores support this view in so far as showing that the higher grade ores contain most of the elements considered rebellious, while the lower grade ores are comparatively free from them, making cyanidation cheaper on the low-grade minerals. In the accompanying table is presented a statement of the comparative content of the extraordinary elements in Cobalt ores of various grades, *A* representing the high-grade, *B* the medium-grade and *C* the low, or milling-grade ores.

Four Mills Practice Cyanidation

Four of the Cobalt companies have undertaken cyanidation in some form and degree. These are the Nipissing Mining Co., the Buffalo Mines Co., the Dominion Reduction Co. and the O'Brien[1]. The Buffalo mill[2] treats partly by concentration and partly by cyanidation. The ore is broken through crusher and rolls and is partly reground in a high-speed chilean mill, the crushing and grinding being done in water. The slime is separated, thickened in a Dorr thickener and cyanided in Pachuca tanks, the sand being concentrated in water. The tailing is stacked and may be retreated at some future time. Of the sand reground in the chilean mill, only about 5% is slimed, the total quantity of slime cyanided being only 18 to 20% of the total ore crushed. The —200-mesh product is considered as slime and it is largely a granular product, there being very little colloid in it.

New Low-grade Mill of the Nipissing Mining Co., Ltd.

[1]The O'Brien is the property of one man, is not incorporated and is known simply as the O'Brien mine.

[2]Eng. and Min. Journ., Aug. 3, 1912.

The mill of the Dominion Reduction Co., formerly known as the Nova Scotia[3], crushes with stamps in cyanide solution. The mill was erected for cyanide treatment alone, small allowance being made for concentration, but having lately entered the custom-milling field it was found necessary to reconstruct the mill, due to the different character of ore to be treated, and this work is now in progress, a system of careful concentration being interposed between the grinding and cyaniding departments. The regrinding in this mill is done in tube mills. Under the reformed system the pulp will be passed through a Callow screen with a 30- or 40-mesh wire cloth, the undersize going to sand tables and the oversize being reground and returned to the Callow screen. Thus all the pulp will have to pass the screen eventually. From the concentrators it will be sent to a modified Dorr classifier where the sand will be drained and taken out, receiving a wash of cyanide solution in the classifier, and will then be discarded. The slime, which carries the greater part of the valuable content, will be subjecter to cyanidation by agitation.

At the O'Brien mill the ore is crushed, jigged and stamped, jigging being done in water and stamping in solution. Recrushing is done in Hardinge conical mills. Concentration is practiced, but to a less extent than usual in the Cobalt mills, the pulp receiving only one passage over the tables. The reground pulp is treated as slime, about 75% of it passing a 200-mesh screen.

Nipissing Building New Mill

The Nipissing company has under construction a mill for treating its so called low-grade ores which assay from 25 to 35 oz. silver per ton. This mill, which is scheduled to begin operations in November of the present year, will be a purely cyaniding one, the only variation being a jigging of the crushed ores. The high-grade rock will be removed on a picking belt, and this, together with the rich jig product, will be treated in the present high-grade mill which will be maintained in operation, as at present, for taking care of the high-grade mine ores and the rich product obtained by the picking and jigging methods. There will be no concentration, no tables or vanners having been included in the design of the mill. There will be 40 stamps of 1500 lb. each and four tube mills, 6½x20 ft. Dorr classifiers are to be used for removing the sand which will be tube milled, the entire product being treated by agitation as slime. Zinc-dust precipitation will be used, the standard Merrill triangular press being installed to collect the precipitate. The standard Butters filter will be used for filtering the residue.

The agitation tanks to be used have the flat bottoms and mechanical agitators usually employed by the Butters engineers. The tanks are fitted with decanters and treatment will be by the intermittent or charge system. It is stated that these agitators, while not perfect, will give as good results as can be obtained by the newer forms at costs which are entirely satisfactory in comparison. It is noteworthy that in the face of the more modern forms of agitators, for which higher efficiency and lower costs have been claimed, the older type of agitators are being installed in this modern mill, and also that in spite of the advantages claimed for continuous processes, the charge system will be employed, and all of this sanctioned by a body of engineers which, while not infallible, is fully competent to weigh the advantages of all classes of machinery and make use of the best. The difference of opinion is remarkable and goes to show that neither form of machinery nor method has been able to demonstrate so clearly its superiority as to make it universally accepted. It seems almost certain that one or the other of two forms of machinery, or even of processes, must be the better, the only explanation of the varying opinions being that different ores must give different results when handled by the different processes. Neither is the personal equation to be eliminated, for operators accustomed to a certain class of machinery and certain methods of working, do not relinquish them with facility, and it is often the most difficult thing in the world to convince an operator that there is some better way of doing things than the particular one he is using.

The Question of Stamps

The persistent use of stamps for reducing rock to various degrees of fineness is an example of the general disinclination to dispense with a form of machinery which has been in use a considerable length of time and which, all things considered, has given a vast amount of satisfactory service. It is difficult to censure the profession for sticking to a device which has served well, but it is nevertheless true that circumstances alter cases, and a machine ought to be considered in the light of the work it is expected to do. When the primary object was to crush ore to a point necessary to liberate its mineral and make it susceptible to amalgamation, then the stamp was a good medium to use. It did the work at one step, and had advantages for amalgamation. It made comparatively little slime, and this was an advantage, particularly in the days when cyanidation was first used and leaching was the accepted practice. The slime was a nuisance and was hard to handle and therefore any machine which produced a minimum of it was considered efficient. With the advent of the total-slime treatment it would seem likely that some other machine might be used which would do the work of reducing ores to a fine state seen, with a pyroclastic bed, the stages-sary to keep the production of slime down to a minimum.

Mill of the Dominion Reduction Co., Cobalt

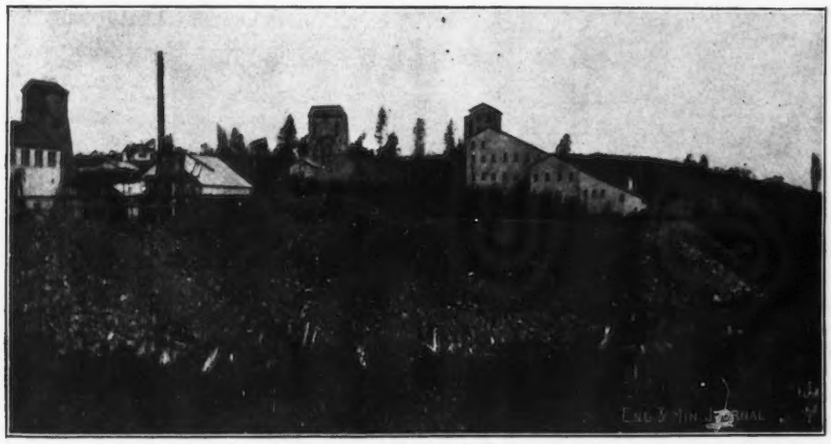
In spite of this circumstance, the stamp continues to be the standard machine for primary crushing, although there is little doubt but that some other form of machine would be more economical in use. This condition exists all over the mining world and Cobalt is no exception. In preparing ores for cyanidation there is no other object but to crush them to the required point, usually a total slime, in the quickest and cheapest way. Yet most mills use stamps for the purpose and in Cobalt the stamp is used except in one instance, the Buffalo mill. All over the world investigations are being made on this detail and in some cases the stamps have been displaced with distinctly good results. I think that if some trials were made on the Cobalt ores these economies would be manifested there also. The Cobalt ores are hard, but not too hard to

[3]Eng. and Min. Journ., June 8, 1912.

be crushed through rolls, and a stage crushing through crushers, rolls and tube mills would seem to indicate the most economical method. It is to be hoped that the system will be given thorough trials on the ores of the camp for such a system would remove many vexations in addition to introducing economies.

Tube Mills Generally Used

Tube mills are used for regrinding in the majority of the mills in the Cobalt camp. The Nipissing, new and old mills, the Dominion and the O'Brien mills have installations of them while the Buffalo, as has already been mentioned, uses a high-speed chilean mill. There is no data at hand for comparing the results of the two forms of machines, but it is probable, on this ore, that the tube mill will give more consistent results. The Hardinge conical mill, as used at the O'Brien mill, has not proved to be altogether satisfactory. The mill is apparently good as a granulator, reducing the rock to a state of medium fine sand with efficiency, but



O'Brien Mill, Cobalt, Ont.

it does not grind fine enough. In this regard the ordinary tube mill is more satisfactory. It is possible to slime the rock in the Hardinge mill, but to do so would reduce its capacity so far as to remove it from consideration as an economical machine. It is possible that the hardness of the ore has something to do with this result for, as has been mentioned, the ore is extremely difficult to slime.

Pachuca Tanks for Agitation

Pachuca tanks are used generally for agitation except in the cases of the Nipissing company, and at Dominion mill where Trent agitators are at present in use. The Pachuca tanks used in the district are somewhat modified, not conforming exactly with the standard sizes and proportions used in Mexico and in the United States, the difference being that they are not so high in proportion to the diameter. While this reduces the capacity, there is no effect upon the agitation except, perhaps, that it requires less power to accomplish the desired result.

The Parral type of agitator is to have a trial in the camp at the new high-grade mill of the Buffalo company, now under construction. This plant, which is, in the main, similar to the corresponding plant of the Nipissing company, contains some details which are considered to be improvements and will be referred to later. In view of the fact that it has been difficult for metallurgists to agree upon the most satisfactory tank for agitation, it will be interesting to have a comparative exhibition of the three classes, Pachuca, Parral and mechanical, at work in the same camp and upon the same material. It is to be hoped that full details of the results will be obtainable.

Lime in General Use

Lime in some form is used at all the cyanide mills in the camp. At the O'Brien mill the dry lime is added in the batteries and in addition caustic soda is used in the solutions. Caustic soda is not usually considered a good agent to use for securing alkalinity as it tends toward dissolving some compounds which would be better left untouched. There are, however, some cases where its use is justified in spite of its chemical conduct and its cost. The alkalinity at the O'Brien is carried at 3 lb. in terms of NaOH. At the Dominion mill dry lime is added to the ore going to the mill at the rate of about 6 or 7 lb. per ton. The lime is in fine lumps, not powdered, as it is desired to take advantage of the alkalinity developed by the slow solution of the lumps. At the Buffalo mill lime is added in powdered form to the treatment tanks at the rate of 7 to 8 lb. per ton of dry ore. The addition of the lime to the treatment tanks in this case is due to the fact that the pulp here meets the cyanide solution for the first time, the preceding operations being carried out in water.

It will be noted that there is a great deal of difference in the manner of using lime in this district, every operator having some special ideas of the most efficient way. Naturally, the lime will be used in the way which seems to be best adapted to each particular ore, but in this case the use of it typifies the state of cyanide practice in the district. It is as yet unsettled, and the best methods for economical results have not yet been definitely determined.

Lead Salts Not Favored

The use of lead salts is varied and spasmodic. There seems to be no definite information as to whether or not they are required and their use, even in the same mill, is not systematized. The general tendency seems to be to dispense with their use. At the Buffalo mill it is claimed that there is no noticeable difference in results whether the lead salts are used or not, and the same is true at the O'Brien mill. Solution analyses at the O'Brien have convinced the operators that the sulphur, which exists in appreciable quantity in solution, is in the form of sulphocyanide. This would indicate that the soluble sulphides, which are undoubtedly first formed, have been transformed by action of the metal elements extracted from the ore and subsequently by the cyanide solutions themselves. If this is true it shows that a portion of the cyanide is removed from its primary object of dissolving silver and is tied up with the sulphur, forming a compound which, while having a certain solvent action upon silver, would certainly not be intentionally formed for such purpose. It would apparently be more economical to remove the sulphur definitely from the solution, if possible, leaving the cyanides free to carry out their designed function. It is probably true that the Cobalt ores carry elements which themselves form insoluble sulphides with the dissolved sulphur and remove them, at least partially, from the solutions.

The consumption of cyanide is much the same in all the mills, leaving out, of course, the Nipissing high-grade mill, which is not to be considered with the mills treating large quantities of lower grade ores. From 3 to 6 lb. of KCN per ton of ore treated is the average consumption, when treating ores running from 20 to 35 oz. of silver. At the O'Brien mill the consumption for the year 1911 was 5 lb. KCN per ton of ore treated, while for the present year the records up to date show a consumption of 3.8 lb. per ton. At the Buffalo and Dominion mills the consumption will average about the same and at the Nipissing high-grade mill the figures are reserved from publication, but the consumption is probably high.

Extractions are Variable

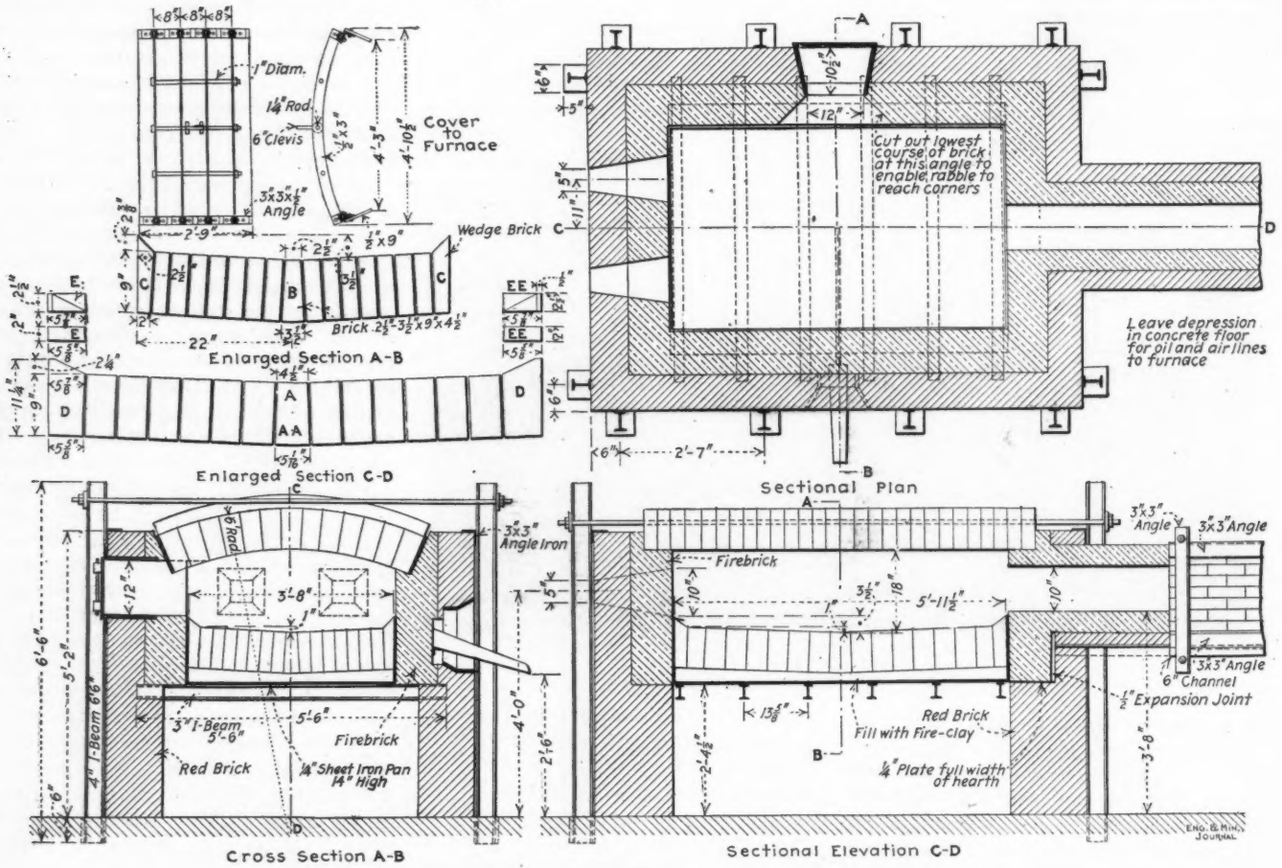
The percentage recovery of silver seems to vary a great deal in the different mills of the camp. From 80 to

90% is about the saving that is attained by cyanidation, except in the Nipissing mill. In the latter a saving is made by amalgamation of 97% and in the subsequent cyanidation a small additional saving is made. The head content of silver at this mill runs about 2500 oz. silver and the tailing is said to be as low as 20 to 30 oz. per ton. The extraordinary percentage of extraction is, of course, accounted for by the richness of the ore treated. At the O'Brien mill concentration and cyanidation reduce 20-oz. heads to a tailing which averages 1 to 1.5 oz. per ton in silver. At the Buffalo mill where only the slime is cyanided the extraction on the material is from 80 to 85%, but this is by the cyanide treatment of the ore which does not permit penetration of the cyanide solutions into the ore particles and requires extreme subdivision in order to expose the maximum amount of the silver to the action of solutions.

Temperature has also a great effect upon extractions. In the winter season the cold solutions lower extractions to a large extent and it is often necessary to warm the solutions in order to obtain normal results. At the Buffalo mill steam coils are placed in the treatment tanks in order to bring the solutions up to normal efficiency. In this case the warming is particularly necessary, for there is a constant introduction of cold water into the treatment circulation from the grinding department. At other mills where the circulation is entirely cyanide solution, a thorough heating of the mill during the winter season suffices to keep the solutions active.

The consumption is in this case 1½ of zinc to one of silver precipitated, by weight. At the new mill of the Nipissing company the same process will be used and the resultant precipitate will be sent to the refinery of the high-grade mill which has already been described.

At the O'Brien mill the process is the same mechanically, but zinc dust is replaced by aluminum powder. It is stated that the aluminum powder will precipitate three times its weight of silver and has a lesser fouling effect upon the solutions. The claim is also made that the resulting precipitate may be melted in the ordinary oil-fired tilting furnace without any flux, giving a bullion of high purity. The cost of the aluminum dust, which is



REVERBERATORY REFINING FURNACE AT BUFFALO MILL, COBALT, ONT.

alone and no comparisons can be made between this result and the results obtained at the other mills in the district. At the Dominion mill no extraction results are obtainable at this time due to the fact that a change of method is being made, and while the mill is actually in operation, the newer method is not yet fully installed and no statement can be made.

It is generally conceded that the percentage extraction depends largely upon the fineness to which the ore is ground, the finer grinding giving a better recovery of metal than the coarser. This is to be expected in view of the density

ZINC DUST FAVORED AS PRECIPITANT

The precipitant most favored is zinc dust which will ultimately be used in practically all the mills. At the Buffalo mill the precipitation is at present by zinc shavings, three wooden boxes of the ordinary type being used. At the Dominion mill zinc dust is used and the regular Merrill triangular filter press is installed for collecting the precipitate.

32c. per lb., compared with the cost of zinc, about 7c. per lb., does not indicate any appreciable economy in the use of aluminum even with its increased efficiency, unless there are some advantages not clearly understood. It is probable that further experiments will be made on the use of this material so that some definite facts may become known and comparisons established with the results accomplished with zinc dust.

VACUUM FILTERS NOT EFFICIENT

Vacuum filters are at present in use in all the mills, the Butters and Moore types being the ones preferred. At the

Nipissing, both the high-grade mill and the new low-grade mill are equipped with Butters filters of the standard type. The Dominion mill has a Moore filter as has also the O'Brien mill. In all these mills a high efficiency is claimed for the filters in washing out dissolved silver, but from the looks of the installations it is rather difficult to understand how high efficiencies can be claimed on any of them. The great weight of the pulp and its granular condition make it necessary that the filter tank be equipped with air lifts in order to keep the solids in suspension, and a rather violent action is necessary to do the work. The filters cannot be operated at all without the air lifts as the heavy solids would settle immediately making operation impossible. From the nature of the ore and the condition of the filters in the Cobalt camp I should think that pressure filters would be likely to give much better results than those operated on the vacuum system. Pressure systems, like the Merrill, would take a definite quantity of pulp and make a fairly homogeneous cake at once, and would tend toward a condition which would facilitate proper washing of the cake. With the vacuum filters some segregation must naturally take place, and a filter cake which is not homogeneous cannot be washed perfectly. The pressure filter would, in my opinion, be a decided improvement over vacuum systems in the Cobalt camp, due to the weight and granular character of the solids in the pulp treated.

Costs Not Generally Obtainable

The cost of treatment in the Cobalt camp is not obtainable in the majority of cases, due to the fact that some of the mills are treating custom ores and consequently do not care to make public that essential part of the business. It may be stated that the treatment of the mill or low-grade ores costs from $2.50 to $4.50 per ton. This seems to be a rather wide variation of cost on ore which is practically identical and which is treated on more or less the same scale. The variation is wide indeed, but, as has already been mentioned, there are so many different ideas and so many different methods in use in the camp that there is bound to be a variation in cost. Probably the cost for cyanidation is less at the Buffalo mill because of the small extent and simplicity of the treatment, most of the charge for reduction being made against the concentration department. At the Buffalo, the cost may be said to be about the lower figure given, while at the other two mills costs varying at or about the higher figure may be taken as representing the average. At the Nipissing no costs at all are divulged, but the report of the company for the year 1911 shows that the cost per ounce of silver at the high-grade mill was 1.14c. At this rate, considering the average ore treated as assaying 2500 oz. per ton, the cost per ton of treatment would be $28.50, which seems to be a fair average figure for an operation of this sort. It seems likely that the majority of this cost consists of cyanide consumed and mercury lost, the other charges being of comparatively less importance.

The cost of material at Cobalt is about as follows: Cyanide, (KCN universally used) 15c. per lb.; zinc dust (90% metallic zinc) 6.5 to 7c. per lb.; pebbles (imported) $20 per ton. Power varies somewhat in cost, the original contracts being made on a basis of $50 per horsepower-year, but the contracts now being made are at the rate of one cent per kilowatt-hour, due, I understand, to a change in the policy of the power companies which serve the district. The cost items in general are not excessive and work should be done at reasonable cost.

Buffalo Company Constructing a High-grade Mill

The Buffalo company is erecting a small mill to treat its high-grade mine product and concentrates, similar to the installation at the Nipissing. The differences are that the tube mill is larger, 5½x22 ft.; the agitation will be performed in tanks of the Parral type; a concentrator with a copper top will be installed over which the pulp will be passed after amalgamation in order to recover any floured quicksilver, and filtration will be performed in a large Perrin plate-and-frame filter press having a capacity of about 20 tons of dry solids. Refining will be performed as at the Nipissing, in a reverberatory furnace, which by courtesy of H. G. S. Anderson, superintendent of the Buffalo mill, I am able to present in detail in the accompanying drawing. The system seems to be well adapted for this class of work and it is not impossible that its use might be profitably extended to other cyaniding installations.

MATERIAL FOR REFINING FURNACE AT BUFFALO MINES, LTD.

Material	Dimensions	Quantity
Red brick	.....	4000
Fire brick	4½x9x2½ in.	1200
Firebrick	4½ and 4x9x3	375
Firebrick "A"	4½ and 5⅛x9x2½	14
Firebrick "AA"	4½ and 5⅛x9x2½.3½	1
Firebrick "B"	2½ and 3½x9x4½	12
Firebrick "C"	.....	26
Firebrick "CC"	.....	2
Firebrick "D"	.....	28
Firebrick "DD"	.....	2
Firebrick "E"	.....	2
Firebrick "EE"	.....	2
I-beams	3 in.x5 ft. 6 in.	6
I-beams	4 in.x6 ft. 6 in.	12
Angle iron	3 in.x3 in.x8 ft. 6 in.	2
Angle iron	3 in.x3 in.x6 ft. 3 in.	2
Rods	¾ in.x8 ft.	8
Rods	¾ in.x10 ft. 3 in.	4
Plates	¾ in.x4 in.x6 in.	12
Oil burners, "Monarch"	.....	2
Fire clay, cu.ft.	.....	10
Sheet iron (pan)	3 ft. 8 in.x5 ft. 11½ in.x 14 in. high	....

Cyaniding Details Not Yet Settled

The details of cyanidation of the Cobalt ores have not yet been definitely settled and the metallurgy is in a state of evolution such that little is really known. There have been few points definitely settled and I expect to see most of the mills make radical changes before settling down to routine work. Many methods are in use which do not seem altogether suited to the conditions and it is likely that these will be gradually changed as some systems prove their superiority. Results obtained in extraction are not yet reliable, as most of them are based on estimates, and the same is true of costs, which are so varied and indefinite as to be not suitable for comparison. There are many skillful metallurgists at work in the district who may be relied upon to work out the processes in time and I have no doubt that the district will reach a state of settled and satisfactory cyanidation after time has been given to allow the problems, which are many and difficult, to be worked out.

TYPICAL ANALYSES OF COBALT ORES OF DIFFERENT GRADES

	A	B	C
SiO_2	4.51	2.88	.....
Fe	2.34	2.80	7.00
CaO	9.05	10.00	3.00
Al_2O_3	1.42	0.87	15.00
MgO	6.22	7.13	.....
Ni	6.62	8.78	.....
Co	7.11	8.42	.....
As	29.88	34.48	0.50
Ag. (oz. per ton)	4786.1	2014.00	71.27

Oil Switch for Small Plants

The smallest oil switch manufactured by the General Electric Co. for switchboard mounting was developed particularly for use in isolated and small plants and will provide adequate protection on alternating-current circuits up to 200 amp. and 3300 volts. The general characteristics of the switch, known as type *F*, form *K* 13, are similar to the larger and more expensive switches for switchboard mounting made by this company.

The entire mechanism and oil tank, except operating handle on front of board, are suspended from a single frame. The oil vessel is of heavy sheet metal lined with an insulating material and provided with barriers between poles. The contacts provide two breaks in each phase and open by gravity. They are of the well known sliding wedge construction, which not only gives a wiping motion to the contacts on opening and closing, thus keeping them clean, but also protects the actual current-carrying surfaces from damage in breaking the arc.

It is reported (*Chem. Trade Journ.*, Oct. 12, 1912), that the Chairman of the Parliamentary inquiry into the question of lead poisoning, speaking at Lancaster, Eng., on Oct. 6, said that the committee would report in favor of the total prohibition of lead in paint.

The Iron Ratio for Converter Cost Comparisons

By DAVID H. BROWNE*

In order to compare the cost of converting copper matte at one plant with the cost of the same operation at another, we have to consider the relative amounts of work done in order to produce blister copper from the grade of matte supplied to the converters. Direct comparison of matte grade is misleading. A converter working on 40% matte performs less than half the work per ton of copper done by a converter working on a 20% matte. Direct comparison by the percentage of iron removed is also erroneous. But direct comparison of the ratios of copper to iron and sulphur in both mattes is accurate and fair to both plants.

These ratios are easily calculated. We must prepare first, a table showing the percentage of copper to sulphur and iron in pure copper mattes and from this prepare a table of ratios.

From Tennessee matte as an illustration, the accompanying table may be constructed.

IRON-SULPHUR-COPPER RATIOS IN MATTE

Cu %	Fe %	S %	Fe : Cu	S : Cu	Fe+S:Cu
10	56	25	5.60	2.5	8.10
15	52	25	3.45	1.67	5.12
20	48	25	2.4	1.25	3.65
25	44	25	1.76	1.00	2.76
30	40	25	1.33	0.83	2.16
35	36	25	1.03	0.71	1.74
40	32	25	0.80	0.62	1.42
45	28	25	0.62	0.55	1.17
50	23	25	0.46	0.50	0.96

The sulphur in these mattes varies very slightly. The 10% matte has about 26%, the 50% matte has about 24%. If we call the average sulphur 25% as is done above, we will be near enough for all purposes. But while the percentage of sulphur varies very little, the ratio of sulphur to copper varies greatly, as shown by the table. The added ratios of Fe and S to Cu show the relative total amounts removed per unit of copper.

This shows that for example, on 20% matte we have 3.65 tons of Fe and S to remove per ton of Cu, while on a 40% matte we have only 1.42 tons to remove. Therefore the comparison of work is obtained by dividing 3.65 by 1.42, which gives 2.57. The plant working on 20% matte is doing 2.57 times as much work per ton of copper as the plant working on a 40% matte.

Now in copper converting, certain factors such as air are a function of iron plus sulphur. Other factors, as flux, silica, etc. are functions of iron alone. Suppose the 20% plant pays $1 for air per ton of blister copper, while the 40% plant pays 50c. The ratio figures given above show that to make the costs the same in both cases, the plant working on a 20% matte would have to get its air for 1/2.57 the price paid by the plant using 40% matte, which is $50/2.57 = 19\frac{1}{2}$ cents.

But on the other hand we may wish to compare the work and not the cost. Then admitting that the superintendent of the plant working on a 40% matte is doing good work in converting at a cost of 50c. for air per ton of blister copper, it follows that the superintendent of the plant working on a 20% matte would be doing equally good work if he paid $50 \times 2.57 = \$1.28$ for his air. But he pays only $1. Therefore he is really doing better work in regard to his air costs than the other man.

We can thus work out from the complete ratios as found by analysis or calculation just what factor to use in multiplying figures of costs, or flux weights, in order to compare the work done at various smelteries, or at various times in the same smeltery. Comparisons at best are odious, but at the worst they should be fair.

*Metallurgist, Canadian Copper Co., Copper Cliff, Ont.

South African 1911 Mineral Output

The mineral output of the Union of South Africa for 1911 was: Gold, 8,251,240 fine oz.; diamonds, 4,891,999 carats; coal, 7,594,944 tons; copper concentrates and matte (47.46% Cu), 23,098 tons; tin concentrates (67.26% Sn), 3534; lime, 79,389 tons; silver, 896,538 oz.; salt, 40,498 tons; asbestos, 1266; flint, 2395 tons. The value of no other single item, excluding certain ceramic products, exceeds £1500.

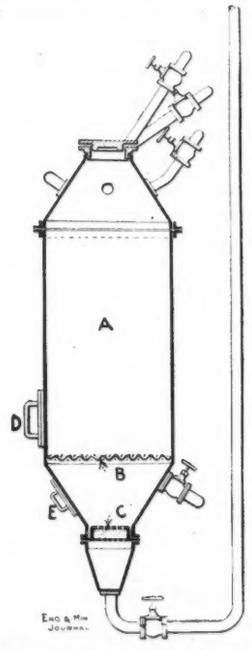
In December, 1911, there were 10,383 stamps and 259 tube mills at work in the Transvaal, as against 9800 and 197 for December, 1910. The Transvaal produced 8,249,461 oz. of the total gold output, milling 24,918,648 tons of ore. The Rand produced 7,910,034 oz. of this gold.

The silver was all produced either from gold bullion, or from base-metal ores. Of the diamonds, 4,758,307 carats came from mining, and 133,691 from alluvial washing. The Messina Development Co. remains the only copper producer of importance in the Transvaal, concentrating 16,475 tons of ore into 1856 tons assaying 50.45% Cu. The Cape Copper Co. and Namaqua Copper Co. in Cape Colony are the largest producers of copper, smelting 136,335 tons of ore producing 17,760 tons of 50.21% matte, and also producing 1058 tons of 30% picked ore and 37 tons of 79% precipitates.

Gadomsky's Copper Leaching Process

A process for leaching copper from slags or from calcined ores has been patented by Antony Gadomsky, of Tiflis, Russia. (U. S. pat. 1,014,868.) The apparatus consists of an upright square sheet-iron prism *A*, divided into three parts by a grate, *B*, and a filter, *C*. The material to be treated is crushed to about 1 mm. and introduced into *A* through the top, and after closing the apparatus equal parts of a 4% solution of ammonium carbonate, and a 4% ammonia solution are introduced. The combined weight of these solutions is about one-quarter the weight of the material to be treated.

A vacuum is then produced under the filter *C*, which draws the finest material with the solution through the grate *B*.



GADOMSKY'S LEACHING APPARATUS

These fines are stopped by the filter. If the solution which passes the filter is strong enough, it is then distilled. If too weak, it is run over the ore again. Air is admitted to the upper part of the cylinder during the filtering, in order to oxidize any unoxidized copper. When the solution is distilled, the ammonia and carbon-dioxide are caught and condensed, while a pasty mass of copper oxide is left in the still, which is then smelted in a blast furnace. The treated coarse and fines are removed through the cleaning doors, *D* and *E*.

The exports of petroleum from Baku for the first half of 1912 are given by the *Petroleum Review*, Sept. 7, 1912, at 3,048,083 metric tons as against 3,040,800 metric tons exported during the corresponding period of 1911.

The Ore Deposits of Goldfield—II

By Augustus Locke *

The lode possesses a number of curious curves in the Goldfield district. Pre-mineral faulting in the plane of the lode is obvious and the ore is localized in fault fractures which constitute mineralizing channels. The relatively small sheet-like orebodies are scattered. The ore is not free milling.

Note—The work on which this article is founded was done under the direction of Henry Lloyd Smith, professor of mining and metallurgy, Harvard University, and while Mr. Locke was a holder of a Sheldon fellowship from Harvard University.

*Mining geologist, Apartado 34, El Oro, Mexico.

The Mohawk, the Red Top, and the Combination properties, of the Goldfield district, possess along their strikes some remarkable curves. These have strengthened the general suggestion of discontinuity of ore in the quartz; for when the miner, in drifting, has come to such a curve, he has been likely to run on into the soft rock, especially if the boundaries of the quartz are ill-defined, and he has been likely to conclude that he has reached the end of the lode.

The Mohawk Curve

The most important of the curves (most important, because, together with its limbs, it has yielded three-quarters of the output of the district) is that which exists in the Mohawk. The simplest conception of this curve is as a wrinkle or anticline (though it is not properly either) the axis of which pitches 30° or so easterly; the south limb strikes northeast and dips 30°, and the north limb strikes nearly west and stands nearly vertical. The north limb extends for a strike distance of about 250 ft. and then joins a portion of the lode having the normal 30° dip and the same strike as the south limb. The curve is possessed not only by the lode, but by the dacite-latite contact, even in the upper levels where this contact is far in the foot wall.

The curve is plainly visible between the 350- and 750-ft. levels. On the 900-ft. level there are strong traces of it, but because of the meagerness of the exploration, the data are inconclusive, and on the levels below they are even more so. The complication of the lode structure obscures the curve in the upper levels.

The situation, then, is this: On the Mohawk levels, between the depths of 750 and 350 ft., the lode is known to curve sharply around from northeast to northwest, and then, in 200 or 300 ft. to turn back again toward the east. The northeast-striking parts dip flat; the northwest-striking part is steep or vertical. And the dacite-latite contact duplicates the curves of the lode.

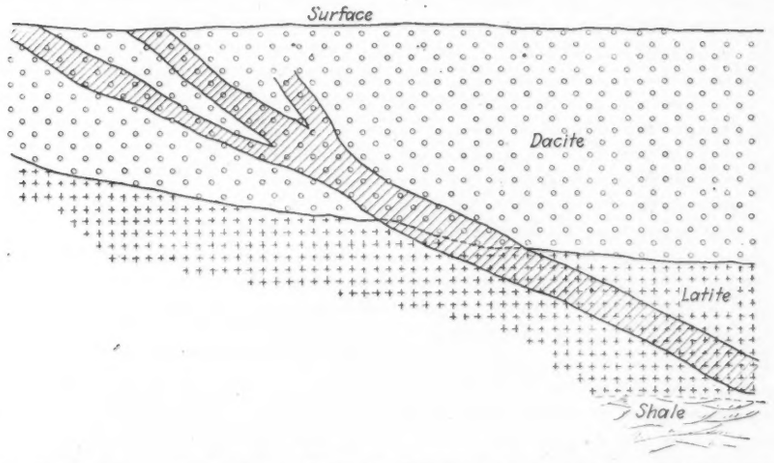


Fig. 1. Diagramatic Vertical Section, Showing Lode on Line of Mohawk, Clermont and Grizzly Bear Shafts

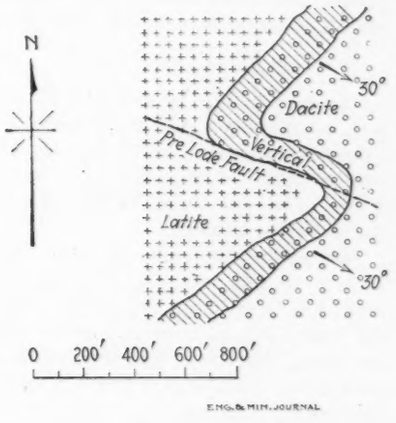


Fig. 2. Diagramatic Plan of Lode Curve on Mohawk 600-ft. Level

No one can study the situation carefully without being puzzled by the Mohawk curve. It is actually difficult at first to realize that the parts of the lode on the opposite sides of the curve are continuous. Exploration, for example, on the 600-ft. level revealed a steep "vein" carrying ore, lying not far north from the flat "vein" and striking at about right angles with it. Orebodies were exploited in both at the same time. Miners looked on the steep "vein" as possibly a spur of the other, but certainly a most inexplicable one.

The steep "vein," it should be said, has a dacite north wall and a latite south wall for a considerable distance below the 600-ft. level, perhaps for as much as 100 ft. The presence of vertical dacite-latite contacts in Goldfield is good evidence of faulting. And surely enough, throughout the whole known extent of the vertical "vein," there exist strong vertical gouges, accompanying and paralleling it; beyond the ends of the "vein," on line with it but out in the country rock, there are additional strong vertical gouges. Altogether, the coincidence of the curve with a fault is sufficiently well established.

Faulting Chiefly Pre-mineral

That the fault preceded silicification and ore mineralization is proved by the fact that ore and quartz occur along it, but the gouges next to the lode sometimes carry rolled pebbles of quartz, and the lode quartz itself is much brecciated. Evidently there was some movement later than the lode mineralization. The amount of this movement, however, was small; for at the junctions of the steep "vein" with the flat "vein," the lode is not noticeably dislocated.

The faulting, then, was chiefly pre-mineral. Evidently, it displaced the channel of mineralization which, as we shall see later, was itself a fault, dipping flatly to the east. The ascending mineralizers came up not only on the original channel, but also on the cross fault which joined its dislocated ends.

The direction and magnitude of the faulting were such that the country to the north of the fault was apparently either depressed a distance of about 150 ft. or moved westward a distance of about 250 ft. The actual direction of movement is not known.

The curve in the Combination is less striking than that in the Mohawk because

in its vicinity the lode is complex and because the curve therefore is recognizable less in the shape of the lode than in the shape of the dacite-latite contact.

The curve is best seen on the bottom, the 380-ft. level. It is noteworthy that the conditions existing in the Mohawk are here almost duplicated, the main portion of the lode strikes northwest and dips flatly northeast, and the portion of the lode immediately beyond the curve strikes southwest and is vertical.

The vertical dacite-latite contact here again creates a strong presumption that faulting has taken place. And the presumption is supported by stronger auxiliary evidence than is the case in the Mohawk; for the region of the supposed fault shows a zone of exceptionally strong gouges and breccias. On the strike of this zone, there occurs a similar vertical dacite-latite contact in the Clermont shaft, 1600 ft. distant, while the vertical plane connecting the fault in the Combination with the Clermont shaft intersects, in the mine workings, abundant evidences of movement.

The considerations concerning the direction and magnitude of the movement on the Mohawk curve apply here also.

The January Curve

The lode in the January stands steep and, on the whole, is well defined. The curve which it describes for nearly 180° with a radius of not much over 100 ft., is one of the most astonishing details of the Goldfield geology.

The exploration on the dacite-latite contact in this vicinity is meager; no proof has been found of the existence of any faults whose presence would explain the curve. Moreover, it is difficult to see how such a half ring of quartz could be directed by faulting.

Ransome[1] believes that the January follows, not a number of intersecting fissures, but a curved line of continuous fissures, and though it is a fact that fissures tangent to the main curve come in from the walls, Ransome's conclusion is altogether the most satisfactory one. The January is probably localized by curved cracks. What caused them to be curved, and, above all, what caused them to be curved in their extraordinary semicircle, we do not know. They are excellent examples of the eccentricity in detail of the Goldfield lode structure. The Florence probably possesses a curve which is convex eastward.

The quartz, after it comes down to the dacite-latite contact, follows it for considerable distances, both on strike and dip. This fact is best illustrated on the 600-ft. level of the Mohawk, where the hanging wall of the lode is dacite and the foot wall is latite for a strike distance of several hundred feet and for a dip distance of perhaps as much as 200 ft. Not far above the 600-ft. level, both walls are dacite; 50 ft. above the 750-ft. level, both walls are latite. Another, but less perfect illustration is afforded by the lower levels of the Combination.

These conditions suggest that the contact was for a certain distance the localizer of the silicification. But there are some serious difficulties attending the acceptance of this hypothesis. In the first place, if the contact was the localizer of the quartz, then it would seem to be in general a good place to prospect. But prospecting here has been fruitless; the contact is often entirely barren of quartz.

Again, the Mohawk quartz (the east-dipping body, not the spurs which depart upward from it) has a straight dip from the upper levels down to the bottom of the mine, the 1200-ft. level. In its descent, it disregards and is undeflected by the rock contact. On the other hand, the contact looks much as though it were itself deflected by the lode; for both above and below the lode the contact is flatter than it is at the place where it coincides with the lode. On the Combination, the situation is similar.

The hypothesis demanded by these conditions is one of lode-faulting. Now, that there has been post-lode movement in the plane of the lode is obvious. The quartz is filled with fissures, fissures not of entirely irregular tendencies, but having a general parallelism with the lode walls, and constituting so definite a feature that when the boundaries of the quartz are vague, they frequently reveal its real trend. Further evidence of post-lode movements is yielded by breccias almost everywhere characteristic of the lode, and consisting of hard quartz units in a matrix which is chiefly pulverized quartz, alunite, and kaolin.

The evidences of pre-lode movement are harder to see, but no less convincing. The fact that the rock contact follows the lode for a certain distance and steepens when it does so, suggests that the contact was faulted by the lode. And again, the very existence of a lode with a straight dip, traversing at an acute angle and ignoring a contact between successive flows of volcanic rocks, and persisting for a dip distance of at least 2000 ft., is presumptive evidence of previous faulting.

Magnitude of Lode-faulting Uncertain

The only measure which we have of the lode-faulting is its displacement of the dacite-latite contact. In the Combination, this is determined to be about 300 ft., as measured on the dip. (The points at which the contact steepens and flattens are known only approximately.) In the Mohawk, my only positive knowledge concerning the amount of the displacement is that it is between 40 and 200 ft. as measured along the dip.

I have not been able to prove that the vertical or steep quartz bodies follow faults of any considerable magnitude. These bodies, it will be noted, do not pass down through the dacite-latite contact. Until exploration is carried on below them in the contact locality, the question of their throw must remain unanswered.

Ransome maps what he terms the "Columbia Mountain Fault" some distance north of the producing locality but situated on the prolongation of its strike. The fault strikes northerly and dips easterly 20° to 55°. Ransome concludes that its displacement may be as great as 1000 ft.; that the greater part of its movement occurred before the dacite and after the latite had consolidated; that a minor portion of it occurred after the dacite had consolidated, and that this portion was probably the movement which localized the lode quartz.

It is difficult to avoid the conclusion that the lode movements are a southward prolongation of the Columbia Mountain fault movements. But I cannot see any convincing proof that a part of the Columbia Mountain fault movements took place before the consolidation of the dacite. The smallness of the observed displacements in the dacite constitutes no such proof; for it would be expected that in a rock so exceedingly decomposed as the dacite, the movement would be diffused rather than concentrated; that, therefore, no large displacement would be visible in any one place.

The Localization of the Lode Fault

A fault of such flatness and persistence as that which localized the lode in the Mohawk must be regarded as extraordinary. Persistent, flat fissures are known elsewhere, but they either occur in brittle rocks, as at Grass Valley, or they coincide with some structural feature, such as a rock contact. But in Goldfield, the bulk of the rock is soft; the lode ignores the rock contacts, and there is no easily visible structural feature with which it can be connected.

The quartz, as has been before stated, is not "open space" material, but material produced by the alteration of rock. And it possesses peculiarities which denote its lineage; silicified dacite is usually distinguishable from silicified latite. Above the dacite-latite contact, the lode material is universally silicified dacite. Below this contact, the lode, though chiefly silicified latite, has a narrow portion of superior hardness and richness which is not latite.

For some time I was inclined to believe that this portion was a greatly altered dacite dike. It has a width of

[1] U. S. Geological Survey, Professional Paper No. 66. "Geology of Ore Deposits."

one-half to 20 ft.; it has the dark color and flinty character of the typical dacite quartz; occasionally it carries phenocrysts of quartz and always it is easily distinguishable from the softer silicified latite which constitutes its walls.

But although to the unaided eye, it appears to resemble dacite, under the microscope it shows no characteristics which would tend to identify it as such excepting the possession of the quartz phenocrysts. Moreover, it is exceedingly decomposed and silicified, it contains many small fragments of shale and granite, and it frequently has a marked fragmental structure.

There exists, then, in the interior portion of the lode, where the lode lies in latite, a narrow dike-like or vein-like body of quartz, derived by silification from a rock whose characters are observed by alteration, but which looks fragmental. It must be confessed that the evidence contained within this body of quartz is difficult to interpret. But in the latite outside the lode, there are occurrences of similar material whose characteristics are much plainer, and these furnish the key to the riddle.

The material referred to is a breccia which consists of a fragmental rhyolytic matrix carrying numerous inclusions of granite and shale of a maximum diameter of two inches. I found it lying in several tabular bodies not over two feet wide which are apparently limited in extent and detached, yet they usually strike and dip parallel with the lode.

The material is plainly pyroclastic. Being pyroclastic, its existence means that the latite was deposited in successive flows, intercalated with rhyolitic ash. Once it is realized that the latite has a bedding parallel with the lode, it is hard to escape the conclusion that it was this bedding which localized the lode faulting.

The puzzling interior portion of the lode is then a pyroclastic bed. This does not mean that the lode everywhere in latite coincides with a pyroclastic bed; it is known so to coincide only for a distance of about 500 ft. on the dip and of about 500 ft. on the strike. Perhaps, beyond the present exploration, the bed is non-persistent, or perhaps the lode actually leaves it. A not inconceivable situation would be that in which the lode would jump from one bed to its parallel, and not far distant, neighbor.

Upper Portion of Lode Complex

I have sought pyroclastic beds in dacite but have not succeeded in finding them. How then was the lode faulting localized here? I look upon the lode faulting in the dacite as the upward projection of the movement, directed by the latite structure. The lode is more complex in its upper or dacite portion than in its lower or latite portion. It appears that in the latite the fracturing was simple because of the presence of the latite structure, and that in the dacite it was complex because of the absence of any such structure. This does not prevent the acceptance of the hypothesis that the fracturing in dacite owes part of its superior complexity to the superior lightness of the load under which it occurred.

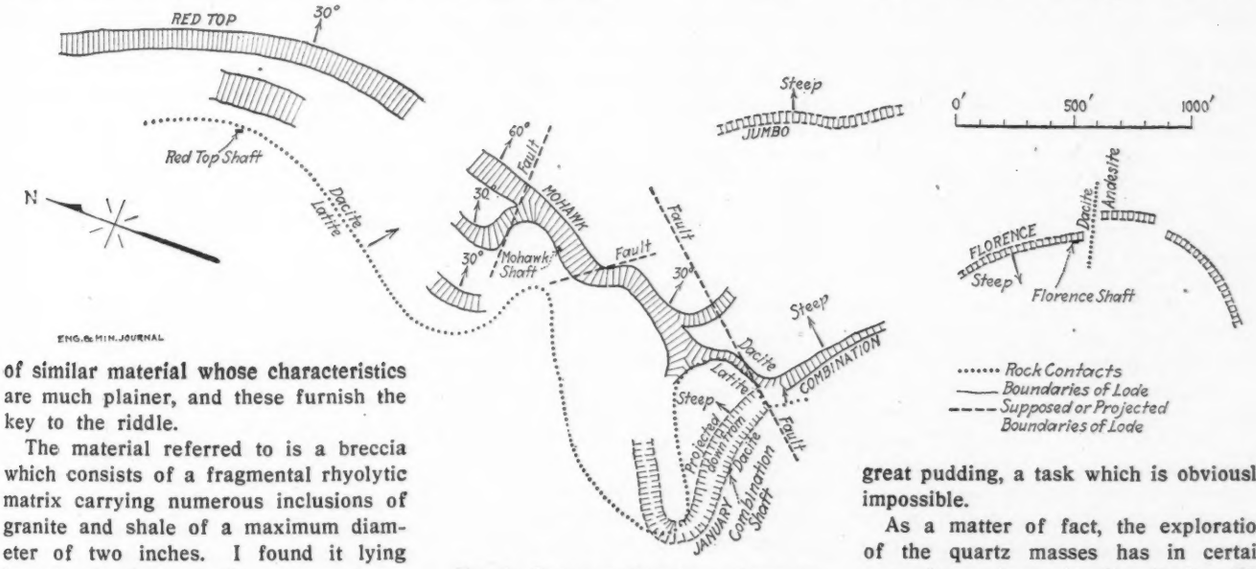


FIG. 3. PLAN OF GOLDFIELD LODE AT DEPTH OF 350 FEET

We have in Goldfield a copy with blurred outlines and on a reduced scale, of the Comstock. In it, the east-dipping lode fault corresponds to the great footwall Comstock fault, and the steep, upspringing branches to the hanging-wall branches of the Comstock. That the Goldfield lode exceeds the Comstock in irregularity of outline is perhaps due to the smallness of the lode-fault movement, to the softness of the rocks in the area of solfataric decomposition, or again, to the absence of "open-space" quartz and to the original absence of well defined and extensive spaces for the circulation of silicifying mineralizers. (These conditions could of course be inter-related.) It will be recollected that the Comstock has brittle rocks, "open-space" quartz in enormous quantity, and a lode-fault displacement of several thousand feet.

Ore Distribution Not Entirely Erratic

The old simile of plums in a pudding illustrates fairly well the distribution of the orebodies within the quartz masses. It applies as accurately to Goldfield as it does, for example, to the Comstock. But we shall widely miss the truth if we conclude that the distribution is entirely erratic, that exploratory work beyond the end of an orebody finds one part of the lode as inviting as another. In the latter part of 1910, the aggregate lode areas revealed in all the levels of the Goldfield Consolidated amounted to about one and one-half million square feet. Of this slightly over 6% was occupied by ore. Now, if the discovery of one orebody gave no clue to the position of its undiscovered neighbor, the task of finding the plums would involve the eating of the whole great pudding, a task which is obviously impossible.

As a matter of fact, the exploration of the quartz masses has in certain cases been almost ideally simple. The exploration of the Jumbo, for instance, was a matter of sinking on ore and drifting on fractures. In certain other cases, a large amount of drifting and crosscutting in barren material has been necessary. Thus, the Mohawk quartz in the upper levels possesses several spurs whose connection with each other is even now not completely traced; the orebodies which inhabit them were at first well hidden.

But even in the Mohawk, the isolation of one orebody from another is more apparent than real. The stopes from which the bulk of the Mohawk and Clermont production has come occur in succession from the 250 to the 1000-ft. level (the distance along the dip of the ore is about 1500 ft.) and are so situated that a straight line can be carried through them. At present, these

stopes have the appearance of lying in several discrete orebodies. Had the miner been content to exploit them with less impatience, working gradually from the top downward, he would in all probability have found them continuous.

The haphazard suggestion in the distribution of the orebodies is exaggerated by the frequent fickleness of the gold content. A drift penetrating an orebody may give little indication of the quality of its ore. Important stopes grow from most unpromising indications and, on the other hand, promising indications lead to nothing. Ore cannot be accurately estimated until it has been broken. Because of these conditions considerable time is required to prove the connection between the several parts of a single orebody, and meanwhile the several parts may look like erratically arranged individuals.

Orebodies Relatively Small

The orebodies of Goldfield are smaller than those of the Comstock; they have no such extent along the strike as is possessed by the orebodies of the Mother Lode in California, or even by some of those in Cripple Creek. The least extensive are excellently described by Ransome as follows: "Small, irregular, isolated bunches of ore, often of high grade, are rather characteristic of the district."

DIMENSIONS OF PRINCIPAL OREBODIES IN GOLDFIELD DISTRICT

Name	Situation	Maximum length on strike. Ft.	Maximum length on dip. Ft.	Thickness Ft.
Hampton	Combination mine N. from shaft...	100	250	10–60
	Combination mine immediately S.E. from shaft.....	300	230	5–40
701	Clermont mine 750 foot level.....	150	200	20
	Combination mine N.E. from shaft.	100	180	5–20
	Jumbo.....	500	200	1–20

The largest are typified by the orebody on the 750-ft. level of the Clermont which has a strike length of 300 or 400 ft., a dip length of at least 200, and a thickness from wall to wall of 20 ft. The small ore bunches described above have played but a small part in the history of Goldfield. The bulk, even of the richest ore, has come from the larger bodies. A most important peculiarity of Goldfield has been the occurrence of rich ore, $30 to $100 per ton, in bodies of considerable size. This peculiarity has had much to do with the sudden growth and maturity of the Goldfield mining industry; for it has promoted rapid extraction.

Orebodies Possess Sheet-like Tendencies

The following is from Ransome: "In general, the pay shoots are fully as irregular as the ledges with which they are associated. Some of them are roughly equi-dimensional masses, others are lenticular; some are approximately spindle shaped with the large axis nearly vertical, and still others are tabular or plate-like, although such sheets are often curiously twisted or warped. The striking feature of the orebodies as a whole is the absence of, rather than any approximation to, any regularity of form."

I regard the above as a most vivid description of the conditions of irregularity which exist in certain of the orebodies. Yet I am convinced that, in general, it fails to fit the conditions revealed by the more perfect outlining of the orebodies through recent stoping. The larger orebodies are now known to have usually two dimensions, and always one, parallel with the longer dimensions of the quartz bodies in which they lie. In other words, they are extended along the strike and dip of these quartz bodies, and possess sheet-like tendencies.

The most marked sheet-like tendencies are visible in the Jumbo, in the January, in the Red Top, in the portions of the Mohawk which are below the 600-ft. level, and in one or two of the Combination orebodies. The Jumbo stopes look like those of any locality of narrow, well defined veins.

There are a few stopes in Goldfield in which one wall, usually the hanging, is a gouge seam. But visible, well defined walls of this sort, or, indeed of any sort, are rare. The boundaries of the ore are crooked. The miner can seldom count on stopping his work along a given line; bunches of ore protrude out into the wall. Again, the boundaries are not visible. Only diligent sampling can prevent waste from being broken with ore. It is easy to shoot down 10 ft. of $21 material instead of five feet of $40 material.

But that the boundaries are invisible does not mean that they are vague. One of the finest orebodies in the district was barely missed by an exploratory crosscut which passed it at a distance of four feet without detecting the faintest scent of it. The change from high grade to low grade is remarkably sudden; there is no general gradation between ore and waste; and considerable bodies of intermediate tenor ($5 to $10) do not exist.

Feeders Evident within the Lode

Frequently, there occurs within the orebody a seam, one to six inches wide, of high-grade sulphides. The immediately adjacent ore may carry less than an ounce of gold to the ton. Often such a seam occupies the medial portion of the orebody, and parallels it on dip and strike. Sometimes, it hugs one of the walls. Always, it coincides with a fracture or with a group of fractures which have more continuity than the fractures inhabiting the lower-grade material, and on the whole, it is more tabular than this material.

Now the somewhat vaguely tabular orebody with the more perfectly tabular rich seam in its interior is the situation which would result from the original advent of the ore mineralizers through the seam and their permeation of its walls by metasomatism or through restricted openings. In certain cases, there may have been a subsequent enrichment along cracks within orebodies. On the whole, however, I am inclined to regard the rich interior seams as ore feeders.

The persistence of the rich portions of the seams is not much greater than that of the orebodies themselves. Yet in quartz outside the orebodies (where the quartz is a derivative of dacite) what appears to be the extension of the feeders is traceable for long distances as barren or low-grade, and usually mineralized, cracks. In the Combination mine, for example, the orebody immediately southeast from the shaft is not known to exist below the depth of 230 ft; but on the 280-ft. level immediately below it, and extending in the direction of its strike, a well defined vertical crack, or sheeted zone of parallel cracks, one to four feet wide, is known for a distance of several hundred feet. The crack or cracks are abundantly mineralized with alunite and pyrite. Often they include breccia whose interstitial spaces are filled with secondary minerals, or they contain bodies of secondary minerals, having diameters as great as a foot. Gold occurs only in spots. On the 380-ft. level the mineralized crack or cracks exist with diminished persistence.

These cracks "feed" up directly into the orebody above. Moreover, they serve to form a direct connection along the strike between the orebody just mentioned and one situated several hundred feet further to the southeast. I do not know that there is any absolute proof in this case that the cracks are older than the orebodies, but their distribution inclines me strongly toward this conclusion.

Feeder Walls Barren

An excellent example of the simple medial feeder is afforded by the Combination orebody which extends from the depth of 230 ft. to the depth of 300 ft. on a dip of 20° to 30°. Here

the feeder portion was exceedingly rich, excellently defined, and had a width of several inches; it contained much tough gouge and, though possessing many fragments of quartz, it consisted for the most part of material in a much finer state of division than that of the lower-grade ore. On the 230 and 280-ft. levels the feeder issues from the orebody as a gouge-bearing and pyritiferous seam. To the south, on the lower level, it soon enters latite, and within 100 ft. it is lost. To the north, it joins and is deflected by the strong vertical gouge which constitutes the northeast wall of the main Combination quartz body. As it comes up to the 230-ft. level it steepens until it is approximately vertical, and, as a steep seam, it is traced north for 200 ft. until it mingles with steep cross seams associated with the faulting referred to in the discussion of the Combination curve. South of the orebody it is traced for 400 ft., part of the distance in soft rock.

In its extensions beyond the orebody, the seam carries gold for but short distances, and is distinguishable by a usually well defined gouge. On the 180-ft. and 130-ft. levels it has much the same characteristics as on the 230. The deepest of the ore feeders, and the one which has most certainly been the path of primary ore mineralization, is that on the 1000-ft. level of the Clermont. This is known for a strike distance of about 500 ft. and it has a rich orebody on its southwest end, and a lower grade "base" orebody about 100 ft. from its northeast end.

As has been explained in the description of the lode, the hard quartz of this locality is a silicified pyroclastic bed, lying within a vaguely defined body of rather soft silicified latite. The hard quartz and the feeder coincide. The feeder is excellently shown at the depth of 925 ft. Here its width is one-half to one foot, its dip is 25° easterly, and its black color and flinty hardness distinguish it sharply from the softer and whiter latite-quartz which constitutes its walls. Altogether, it has a strikingly dike-like appearance. But the distinction between feeder and walls in appearance is no more striking than the distinction in value; for while the feeder carries several ounces to the ton, the walls are conspicuously barren.

From the lower levels, the feeder extends upward into the great orebody of the 750-ft. level. I am convinced that from here it rises into the orebodies of the 600-ft. level (though the connection has not been proved) and thence, finally, to the orebodies above.

Feeders Guide Exploration

To trace a feeder requires, as a rule, a great deal of skill. In latite quartz, feeders are usually ill-defined or discontinuous; in dacite quartz, they are often exceedingly complicated, merging with fissures, and weakening or quitting where the quartz softens or where it becomes brecciated. Sometimes to find the feeder is more difficult than to find the orebody. There have been several places, however, where feeders have led the way directly to discoveries, and I believe that with careful study, they could be made to constitute useful guides for exploration.

The richer ore frequently contains pebbles of silicified rock, surrounded by envelopes of ore minerals and quartz. (See Figs. 4 and 5.) The rounded shapes of the ore pebbles have several possibilities of origin: (1) They are waterworn, or (2) they have undergone fault-attrition, or (3) corrosion. The feeder on the 1000-ft. level of the Clermont has excellent pebbles and, as it dips flatly and coincides, as we have seen, with a pyroclastic bed, the suggestion is strong that they may be waterworn. Similar pebbles occur, however, on the upper levels in vertical or steep orebodies, where the chance that they could be waterworn is exceedingly small. For the first possibility, then, there is no convincing argument.

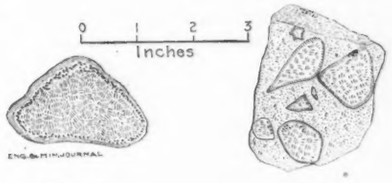


FIG. 4

FIG. 5

Fig. 4. Rich-ore pebble. From interior outwards: (1) Altered latite; (2) crust of sulphides (pyrite, bismithinite, famatinite and pyrite) with visible gold; (3) crust of chalky material (silica and alunite) banded.

Fig. 5. Pebble breccia (low-grade ore), Mohawk 450-ft. level. Pebbles are altered dacite (chiefly quartz with subordinate, alunite and pyrite), each pebble being partly surrounded by an envelope of quartz; immediately inside the quartz is a band resembling rhyolite flow, proving the occurrence of some alteration since time of brecciation. Matrix is fine-grained alunite and quartz with a few sulphides. Dots represent black sulphides.

But the feeder of the 1000-ft. level coincides not only with a pyroclastic bed but also with a plane of some movement. The pebbles are conceivably attrition products, and it is entirely certain that the shapes of some of them, such as those shown in Fig. 4 for example, have resulted largely from movement. We may be sure, too, that a certain rounding off or corrosion of corners has taken place since the time of the movement. The low-grade ore (see Fig. 5) shows the beginning of this corrosion. The high-grade ore shows it at its completion. And it is a noteworthy fact that perfect ore pebbles are by far the most common in high-grade ore where mineralization and, therefore, corrosive action was probably most intense.

Post-ore Faults Difficult to Detect

The conditions are such in Goldfield that post-ore displacements are difficult to detect. Where the ore has crooked boundaries, for example, and where the rock outside the quartz is soft and full of curved gouges, there exists no feature by which such displacement can be marked or measured. In those places, however, where a displacement of the ore would be plainly visible, as where there is a well defined feeder or wall, the only considerable known movement is that in the Florence, where Ransome states that the Engineers' orebody is probably displaced from another orebody a distance of 50 ft. The largest post-ore fault which I have seen exists on the 250-ft. level of the Mohawk, and amounts to 10 ft. It is a notable fact that the faults to which the Mohawk and Combination curves are due pass through ore without displacing it and are themselves ore-bearing. Altogether, the evidence favors the conclusion that post-ore movement has been small.

The lease workings of the mines now owned by the Goldfield Consolidated were chiefly within 250 ft. of the surface and their average yield was slightly over $86 per ton. This is no index, however, of the average richness of the ores of the upper 250 ft.; for the leasers left behind much material of lower grade. Up to March 1, 1911, the ore extracted from above the depth of 600 ft. in the properties of the Goldfield Consolidated, both before and after consolidation, constituted four-fifths of the total production, and yielded $44 per ton. That extracted from below the depth of 600 ft. constituted one-fifth of the total production and yielded $80 per ton.

It is of course likely that $80 is a much higher grade than that which these lower levels will produce in the future. But it must be concluded that there is at present no indication of a general lessening of grade with depth.

Ore Not Free Milling

The gold amalgamates poorly and battery-plates are not used in milling. The richer ores contain a small percentage (in certain cases as high as 2%) of tellurium, but while visible gold in these ores is common, visible tellurides are uncommon. Oxidation does not render the gold free milling. The refractoriness of the gold may be due to its extremely fine state of division.

The concentrates of the unoxidized ore are chiefly native gold, pyrite, bismuthinite (Bi_2S_3), and famatinite ($Cu_3[Sb,As]S_4$). There are occasional small bodies of "base" ore, containing several

per cent. of copper and zinc. There is no indication of any considerable increase of "baseness" with increase in depth, excepting, of course, that the sulphide ores are more "base" than the oxidized ores. The lower limit of oxidation is at an average distance of 150 ft. below the surface. The silver content is insignificant. The ore, except when exceedingly rich, is not practicably sortable.

The characteristics of the orebodies which have chief importance in the determination of the mining methods are as follows: (1) The hanging wall is heavy. (2) Many of the orebodies have a dip so flat that ore will not run on it. (3) The ore is high grade. (4) The orebodies are moderate in size.

The heaviness of the hanging wall necessitates its support during stoping. The stopes are usually too wide for stulls, and the use of square sets, with subsequent filling, is almost universal. The flatness of many of the orebodies necessitates much shoveling of ore and the frequent use of foot-wall drifts. The richness of the ore necessitates careful and therefore costly, stoping. If the grade were low, the boundaries of the stopes would doubtless be much straighter; for in that case the diligent pursuit of protuberances of ore into the walls would be unprofitable.

The moderate size of the orebodies prevents the use of many labor-saving methods, such as mechanical haulage and the mechanical handling of ore in stopes. It is a suggestive fact that the Goldfield Consolidated company is producing less than 1000 tons of ore per day from seven shafts, while the Douglas Island mines are producing several times as much from four or five shafts.

Orebody Expands Upward

There are two known periods of fracturing, the first producing the fractures which localized the lode quartz, the second producing those which localized the ore within it. It seems that the movement of the second followed the same paths as the movement of the first, and was a renewal or continuation of it. The strains which induced the lode faulting, and of which the Columbia Mountain fault is the most clear cut manifestation, were effective over a period which comprehends the periods of solfataric alteration and of ore deposition.

The only useful generalization I can make concerning the reasons why the gold was precipitated where we now find it is derived from the fact that the ore locality expands upward. There is no known coincidence, for the example, between ore and cross fractures. And the fact that the ore locality expands upward forces me to the conclusion that superficial conditions, those of relatively low temperatures and pressures, were the conditions which caused the gold to deposit. This conclusion is most unsatisfactory to the miner; for he would not only have his orebodies prolonged downward, but he would also possess knowledge of some easily recognized sign, indicating definitely the whereabouts of ore.

We have seen that feeders extend beyond the limits of orebodies as seams carrying some gold, but often barren. There is no warrant, under the hypothesis of precipitation which we have been just now considering, for the belief that even the barren parts of the seam were not at one time the paths of ore mineralizers. And I can conceive of an opening not over a few feet long and perhaps now entirely devoid of gold, as having constituted the channel for the mineralization of the whole district. In other words, the absolute disappearance downward of a Goldfield orebody, or, eventually, of all the goldfield orebodies, is not to be regarded as an unsolvable mystery.

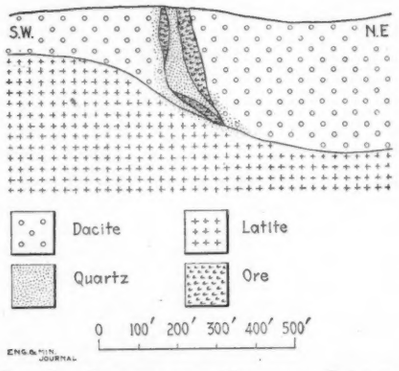


FIG. 6. GENERALIZED VERTICAL SECTION THROUGH THE COMBINATION

The classification of Goldfield as belonging to the group of gold-ore districts having relatively shallow precipitation brings up the large contrast between the new gold deposits and the old, those of Tertiary age, like Goldfield, Cripple Creek, and the Comstock, whose ore expands upward and is high grade, and those of pre-Tertiary age, like Douglas Island and the Mother Lode of California, whose ore occurs without any known dependence on depth, and is low grade. So far, there is little knowledge concerning the precipitation of gold which is of use in mining. Perhaps this large contrast, which was long ago noted, may, at some future time, serve as a basis for such knowledge.

The ore was everywhere localized by fractures which constituted channels for the passage of ore mineralizers. The only materials having sufficient brittleness to afford such channels are quartz and fresh rock. But fresh rock occurs but rarely in the Goldfield district, and the quartz, which in its fractured condition, Ransome vividly likens to a sponge, is the only possible ore container. But why, then, do certain quartz bodies, situated near the western edge of the area of alteration, monopolize the ore?

Fractures, the Third Invariable Condition of Ore Occurrence

I do not believe that these ore-containing quartz bodies differ essentially from the hundreds of barren ledges lying further to the east, or that they possess any intrinsic quality which renders them more hospitable to ore minerals. But, as is probable, it happens that they were fractured in such a way that channels connecting with sources of gold were opened up within them. And these fractures are to be regarded as the third invariable condition of ore occurrence.

Ransome concluded that the solfataric alteration of the rocks was chiefly an acid alteration, effected by the accession of sulphuric anhydride and sulphur, and the removal of lime, magnesia, soda and some potash, and that probably the quantity of silica and iron added was small, the original silica of the rock being sufficient to furnish the silica for the now existing quartz, and the present pyrite gaining its iron from the broken down iron-bearing minerals.

"Open-space" quartz, such as exists in enormous quantity in the Comstock and in the veins of the California Mother Lode, has, in Goldfield, but a meager development. In fact, the largest body of such quartz which I have seen in Goldfield measures not over two inches in thickness. Now, the ore minerals are chiefly an "open-space" filling, and only subordinately a metasomatic deposition. As in Cripple Creek, it is cracks, and not the walls of cracks, which carry gold. And, as in Cripple Creek, this gold was not greatly diluted during deposition by simultaneously deposited gangue materials. Perhaps the smallness and paucity of the cracks had something to do with the richness of the ore.

Ore Younger than the Quartz Lode

General considerations enable us to dismiss the possibility that the "open-space" mineralization is older than the replacement mineralization—in other words, that the ore is older than the quartz in which it lies. The possibilities presented, then, are: (1) The quartz lode and the ore were of simultaneous deposition. (2) The ore is younger.

The first possibility regards extensive silicification as a property of ore mineralization. It explains the general

parallelism of ore and lode by the supposition that the lode was formed with the ore and that the ore remained chiefly within cracks, while the silicifying mineralizers, separated out by osmosis, wandered off into the containing rocks. It will be noted that this is the hypothesis usually employed to explain the limitation of ore minerals to cracks in the solfatarically altered rocks of Cripple Creek.

To this hypothesis there are serious objections. I have seen a number of ore pebbles composed of a hard breccia of quartz fragments and carrying external crusts of ore minerals. Here, ore deposition was plainly later than silicification and cementation, and there is nothing whatever to indicate that the ore minerals are not primary. Moreover, the large facts of ore distribution constitute an argument in the same direction. As we know, the locality of softened rock coincides broadly with that of silicified rock; their coextensiveness suggests strongly that softening and silicification were contemporaneous. But the locality of ore occurrence is vastly smaller than that of silicified rock, and is in no sense coextensive with it.

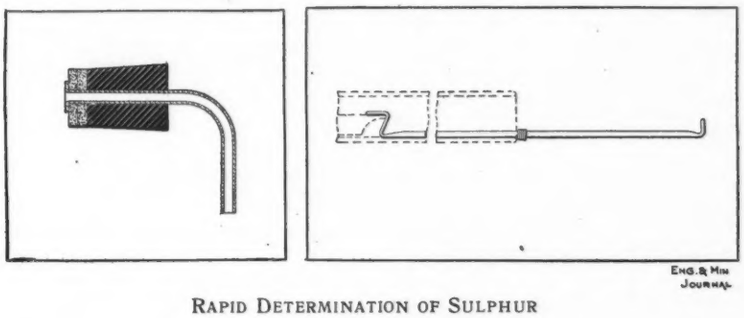
Ore mineralization, then, was not a general accompaniment of silicification; the presumption is that it belonged to a distinct period. And, again, the probability of an osmotic separation of the sort which would account for the sharp boundaries between ore and waste, is vaguely understood. No such separation has ever been conclusively proved to have taken place in ore deposition, and to assume that it had taken place here would be rash. These considerations being taken into account, together with the altogether pertinent fact that the ore minerals inhabit cracks in the quartz, it must be concluded that the second hypothesis is the correct one.

An interesting fact in connection with the production of coal in the United States, from figures compiled by the U. S. Geological Survey, is that in each successive decade the output has been practically doubled.

Rapid Determination of Sulphur in Roasted Blende

The following method is suggested by C. C. Nitchie as a rapid method for the control of blende roasting (*Journ. Ind. Eng. Chem.*, January, 1912). It is stated that results can be obtained in 10 min. from the time of sampling, hence a charge of roasted ore can be analyzed and its exact disposal determined, before it is put into storage. The method depends upon heating the blende in a current of air, absorbing the oxides of sulphur evolved in standard alkali, and titrating the excess.

In blende roasting, some of the original sulphides are left unchanged, while a small part of zinc, some of the lead, and all of the lime are converted to sulphates. On heating the roasted ore in a current of air to a bright red, all of the sulphides are oxidized, giving metallic oxides and SO_2 and SO_3. Sulphates of zinc and lead are decomposed, but calcium sulphate is not, at the temperatures ordinarily reached. However, as the results are to furnish an index as to the completeness of the roast, and as calcium sulphate is not decomposed in roasting furnaces, the results obtained by this method, which may be termed "false sulphur," are the sulphur which, under proper conditions, might have been eliminated in the roast.



RAPID DETERMINATION OF SULPHUR

In the determination there is a copious evolution of zinc-oxide fume as long as any sulphur remains unoxidized. The cessation of this fume furnishes an accurate index to the completion of the reaction. This fume is not appreciably dissolved by the standard alkali, and hence does not vitiate the results. Phenolphthalein is used as indicator, as it is sensitive to both sulphurous and sulphuric acid.

Combustion is carried on in an electric tube-furnace, with a fused silica combustion tube. The ends of the tube are cooled by wrapping them with strips of cotton gauze, which dip into distilled water. Tap water should not be used as it forms a crust of salts over the gauze, decreasing the cooling effect. To avoid burning the rubber stoppers in the ignition tube by radiant heat, these are protected by disks of asbestos, as shown in the illustration, that are held in place by upsetting the ends of the glass tube.

A convenient means for introducing the boat without the necessity of looking to see that it is not overturned, is also shown in the illustration. The device is made of heavy, not easily corroded wire (such as nickel). One end is flattened and so bent that the end projects over the end of the boat, and is in contact with it when both boat and wire are resting on the bottom of the combustion tube. The other end is bent at a right angle to make a hook for withdrawing the boat, and also to indicate when the rod is in the proper position to keep the boat upright. A notch is filed on the nickel wire, or a fine wire wrapped around it as a guide at the point which is flush with the end of the tube when the boat has been pushed to the middle of the tube.

The solutions are simply standard sulphuric acid and sodium hydrate, and the most convenient absorption vessel was found to be the Murray potash bulb.

The car of blende, as brought from the kiln, is sampled in two places by a spear sampler; this sample is cut down with a riffle to about 50 grams, and ground with a few turns of the muller in a Buck's mortar. Fine grinding is undesirable, as it prolongs the time necessary for the analysis by restricting the free circulation of air through the ore.

Details of the Combustion

A measured quantity of standard alkali, seven to 10 c.c. will usually suffice, is run into the absorption bulb, and diluted sufficiently with distilled water to a volume that will bring the solution into the fifth bulb when the air current is passing. The bulb is then attached by a bent glass tube to the exit end of the furnace.

One gram of ore is placed in a combustion boat and introduced into the furnace, which has already been heated to about 1000° C. A moderately rapid current of air, freed from carbon dioxide by caustic potash or soda lime, is passed through the apparatus until the sulphur is completely driven over into the alkali solution. This usually requires about six minutes. When the zinc-oxide fume has completely disappeared from the large bulb of the absorption vessel, the air current is stopped. The absorption vessel is disconnected, washed out into a beaker, phenolpthalein added, and the solution titrated. If total sulphur is desired, add to the "false sulphur" in per cent., four-sevenths the percentage of lime.

Attempts to use the method for the determination of sulphur in raw ores have led to low results, either from failure to absorb the larger quantity of sulphur gases or from condensation of part of the sulphur trioxide on the cooler portions of the tubes.

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20,481—ALLOYS—Die elektrische Leitfaehigkeit der Metallegierungen im fluessigen Zustande. K. Bornemann and G. von Rauschenplat. (Metallurgie, Aug. 8 and 22, 1912; 24 pp., illus.) Electric conductibility of metallic alloys in the liquid state. 80c.

20,482—BRONZES—The Thermal Diagram with Special Reference to the Bronzes. William Campbell. (Advance sheets, Am. Inst. of Metals, Sept., 1912; 16 pp., illus.)

20,483—FLAMELESS COMBUSTION. Carleton Ellis. (Bull. A. I. M. E., Sept., 1912; 31 pp., illus.)

20,484—MANGANESE BRONZE TESTS. Wm. M. Corse and V. Skillman. (Eighth International Congress of Applied Chemistry, Sept., 1912; 6 pp.)

20,485—METALLOGRAPHY—Das System Bleiglanz-Antimonglanz und die Laugerei antimonhaltiger Bleiglanze. Karl Wagenmann. (Metallurgie, Aug. 22 and Sept. 8. 1912; 10¼ pp., illus.) The system galenite-antimonite and the leaching of antimoniferous galenas. 80c.

20,486—OXYGEN—The Influence of Oxygen on the Properties of Metals and Alloys. E. F. Law. (Engineering, Sept. 27, 1912; 2 pp., illus.) Paper before Brit. Inst. of Metals. 40c.

20,487—SMELTER FUMES—Notes on Bag Filtration Plants. Anton Eilers. (Eng. and Min Journ., Oct. 5, 1912; 3¼ pp.) Abstract of paper before Internat. Congress of App. Chem., Sept., 1912. 20c.

20,488— SMELTER-SMOKE CONSERVATION. George C. Westby. (Journ. Ind. and Eng. Chem., Oct., 1912; 3¼ pp.)

20,489—SMOKESTACKS — Design and Construction of Smokestacks. (Can. Engr., Sept. 19, 1912; 2 pp., illus.) 20c.

20,490—TESTING—Etude sur les Nouvelles Methodes d'Essais Mecaniques des Metaux. R. Guillery. (Bull. Soc. Ing. Civ. de France, Mar., 1912; 32 pp., illus.)

MINING AND METALLURGICAL MACHINERY

20,491—AERIAL TRAMWAY—Operation of Argentina Tramway. C. A. Tupper. (Eng. and Min. Journ., Sept. 28, 1912; 2¼ pp., illus.) 20c.

20,492—AIR COMPRESSOR—Eine neuzeitliche schwedische Druckluftanlage. Eriksson. (Glueckauf, Aug. 24, 1912; 4 pp., illus.) A modern Swedish air-compressor plant. 40c.

20,493 — AIR-COMPRESSOR CYLINDER LUBRICATION. L. A. Christian. (Mines and Minerals, Oct., 1912; 1½ pp.) 20c.

20,495 — DIVING APPARATUS — Deneuen Tauchgeraete "Westfalia." Grahn. (Glueckauf, Sept. 7, 1912; 3 pp., illus.) The new driving armor "Westphalia." 40c.

20,496—DREDGES Operated by Oil Engines. (Eng. News, Sept. 12, 1912; 2½ pp., illus.) 20c.

20,497 — DRILLS — Steam Hammer Drills. P. B. McDonald. (Eng. and Min. Journ., Sept. 28, 1912; ¾ p., illus.) 20c.

20,498—ELECTRIC POWER—Use of Electrical Energy in the Mines of the Empire District. (Elec. Wld., Aug. 31, 1912; 4 pp., illus.) 20c.

20,499 — EXCAVATORS — American Earthwork Machinery. No. IV. (Engineer, Aug. 30, 1912; 1¾ pp., illus.) 40c.

20,500—GAS ENGINES—A New Type and Method of Construction of Large Gas Engines. Alan E. L. Chorlton. (Iron and Steel Inst., Sept., 1912; 21 pp., illus.)

20,501—GEARS—Determining Pitch of Gears. Douglas Waterman. (Min. and Sci. Press, Sept. 14, 1912; 1¼ pp., illus.) 20c.

20,502—HOIST—Electric Hoist at Hecla Mine, Burke, Ida. E. M. Murphy. (Bull. A. I. M. E., Sept., 1912; 18 pp., illus.)

20,503—HOISTING by Electricity in Mines. (Coal Age, Sept. 7, 1912; 2¾ pp., illus.) 20c.

20,504—HOISTING ENGINES—Untersuchungen an elektrisch und mit Dampf betriebenen Foerdermaschinen. Bobbert. (Zeit. des Vereines Deutsch. Ing., Sept. 7, 1912; 4¾ pp., illus.) Investigations of winding engines driven electrically and by steam.

20,505—LOCOMOTIVES—German Electric Mine Locomotives. A. Gradenwitz. (Eng. and Min. Journ., Oct. 5, 1912; 2 pp., illus.) 20c.

20,506—LUBRICANTS—Pruefung und Bewertung der Schmiermittell Holde. (Zeit. des Vereines Deutsch. Ing., Aug. 31 and Sept. 7, 1912; 9¼ pp., illus.) Testing and valuing of lubricants.

20,507 — LUBRICATION — Economical Lubrication. W. W. Davis. (Lake Superior Min. Inst., Aug. 1912; 10 pp., illus.)

20,508—MINE CARS—Fahrbare Kipp vorrichtung fuer Foerderwagen. Rath. (Glueckauf. Sept. 14, 1912; ½ p., illus.) Movable tilting device for mine cars. 40c.

20,509—OIL FUEL EQUIPMENT—Dimensions of Boiler Chimneys for Crude Oil at Sea Level and at Various Altitudes, with Correct Factors for Fuel Economizers. C. R. Weymouth. (Journ. A. S. M. E., Oct., 1912: 44 pp.)

20,510—PUMP—Versuchen an einer Stufenkolbenpumpe. Fritz L. Richter. (Glueckauf, Aug. 3, 1912; 10¾ pp., illus.) Tests made on a stepped piston pump. 40c.

20,511 — SECTIONALIZED MACHINERY for Inaccessible Regions. Charles C. Christensen. (Min. and Eng. Wld., Sept. 14, 1912; 2 pp., illus.) 20c.

20,512—STONE CUTTING—Electricity in Stone-Cutting Plants (Elec. Rev., Aug. 17, 1912; 6¼ pp., illus.) 20c.

20,513—TRENCHING AND DITCHING MACHINES. American Earthwork Machinery. Nos. V and VI. (Engineer, Sept. 13 and 27, 1912; 3 pp., illus.) 60c.

SAMPLING AND ASSAYING

20,514—ARSENIC AND ANTIMONY—The Estimation of Arsenic and Antimony. Harley E. Hooper. (Eng. and Min. Journ., Oct. 12, 1912; 1½ pp.) 20c.

20,515—CARBON—Die Bestimmung des Kohlenstoffs auf Nassem Wege. Simonis and Thies. (Chem. Ztg., Aug. 13, 1912; 1¼ pp., illus.) 20c.

20,516—FILTER—A New Type of Inorganic Filter for Laboratory Purposes. M. A. Williamson and P. A. Boeck. (Journ. Ind. and Eng. Chem., Sept., 1912; 4 pp., illus.) 80c.

20,517—PHOSPHORUS AND ZINC—Ueber Fehlerquellen fuer Phosphor- und Zinkbestimmungen bei Verwendung von bestimmten Laboratoriumsglaesern. A. Vita. (Stahl u. Eisen, Sept. 12, 1912; 1 p.) 40c.

20,518—RAPID METHODS of Technical Analysis. Frank D. Aller. (Colo. School Mines. Mag., Oct., 1912; 3½ pp.) Continuation of article previously indexed.

20,519—RARE EARTHS—The Quantitative Separation of Lanthanum from Yttrium. C. James and T. O. Smith. (Journ. Am. Chem. Soc., Sept., 1912; 3 pp.) 80c.

20,520—SAMPLING CONE. C. W. Kneff. (Journ. Ind. and Eng. Chem., Sept., 1912; ½ p., illus.) 80c.

INDUSTRIAL CHEMISTRY

20,521—AMMONIA—Synthetic Ammonnia. H. A. Bernthsen. (Am. Fertilizer, Oct. 5, 1912; 8 pp.) Paper before Internat. Congress of App. Chem., Sept., 1912. 20c.

20,522—ATMOSPHERIC NITROGEN—Oxidation of Atmospheric Nitrogen and Development of Resulting Industries in Norway. Samuel Eyde. (Journ. Ind. and Eng. Chem., Oct., 1912; 3 pp.) Lecture before Internat. Congress of App. Chem., Sept., 1912. 60c.

20,523 — SULPHURIC AICD — Calculation of Sulphuric Acid Stock by Approximate vs. Accurate Methods. A. Special Slide Rule for this Purpose. H. C. Moore. (Journ. Ind. and Eng. Chem., Sept., 1912; 2¼ pp., illus.) 80c.

20,524 — SULPHURIC ACID — Contact Sulphuric Acid from Brimstone. G. W. Patterson and L. B. Cheney. (Am. Fertilizer, Oct. 5, 1912; 2¼ pp., also Journ. Ind. and Eng. Chem., Oct., 1912; 2 pp.) Paper before Internat. Congress of App. Chem., Sept., 1912.)

20,525 — WATER PURIFICATION in Power Plants. (Coal Age, Sept. 7, 1912; 2 pp., illus.) 20c.

MATERIALS OF CONSTRUCTION

20,526 — CONCRETE — Oil-Mixed Portland Cement Concrete. Logan Waller Page. (U. S. Dept. of Agriculture, Bull. No. 46, 1912; 28 pp., illus.)

20,527—FIREBRICKS — Manufacture of Firebricks by Intercolonial Coal Mining Co. (Can. Min. Journ., Sept. 15, 1912; 1½ pp., illus.) 20c.

20,528—PORTLAND CEMENT—Electricity in the Portland Cement Industry. F. C. E. Burnett (Proc. A. I. E. E., Sept., 1912; 24 pp., illus.)

20,529 — PORTLAND CEMENT —The Australian Portland Cement Co.'s Works, Geelong, Victoria, Austral. (Min. and Eng. Rev., Aug. 5, 1912; 2 pp., illus.) 40c.

20,530—TESTING CEMENT—Technische Prufungsmethoden von Zement. Hentschel. (Chem. Ztg., July 18, 1912; ½ p.) Technical testing methods for cement. 20c.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Edwin J. Collins has returned to Duluth, Minn., from a 10 days' business trip in Nevada.

H. A. Linke, manager of the Nevada Central Copper Co., left Chicago, Oct. 24, for the camp at Cedar, Eureka County, Nevada.

Quincy A. Shaw, president, and Rudolph L. Agassiz, vice-president, of the Calumet & Hecla Co., are visiting the mine on their semi-annual tour of inspection.

Frank M. Terry, resident director of the Butters mining interests in Salvador and manager of the Creston-Colorado Co. in Mexico, is spending a few weeks in New York.

George D. James, of Salt Lake City, has made a professional trip to the mining districts west of Milford, Utah, for the purpose of investigating the resources of that section.

Stephen R. Birch in charge of Morgan-Guggenheim copper interests in Alaska has been elected vice-president of Braden Copper Co., succeeding Edgar J. Meyer, deceased.

Harold C. E. Spence left, Oct. 21, for the northwest of Newfoundland and the south coast of Labrador, to examine large oil shale and other deposits. He will be absent for a month.

Alfred Oughton Vale, who, when last heard from, had just left Dove Springs, Calif., for British Columbia, is requested to communicate with his relatives in Birmingham, England.

C. Dawes Clark left New York recently for New Mexico, where he will examine a mining property for W. Rowland Cox & Staff, returning to New York about the middle of December.

Jean Brustlein, of Unieux, Loire, France, has arrived in this country to study American methods of steel making, and is now attached to the Midvale Steel Works, Philadelphia.

James Cronin, of Spokane, Wash., has been appointed general manager of the Standard silver-lead mine, at Silverton, B. C., owned principally by the John A. Finch interests, of Spokane.

Charles Butters arrived in New York last week after an absence of several months in Europe. He will leave shortly for Cobalt, Ont., to be present at the commencement of operations at the Nipissing mill.

Edwin O. Dane, of Denver, Colo., and El Oro, Mexico, has returned to Denver after making mine examinations in the Kingman district, Ariz. He will leave Denver shortly to examine Colorado properties for Eastern investors.

T. M. Schumacher has resigned as traffic manager and director of the American Smelting & Refining Co., and has been appointed vice-president of the El Paso & Southwestern R.R. Co., which is controlled by the Phelps, Dodge & Co. interests.

Dr. J. A. Holmes, director of the U. S. Bureau of Mines, is in San Francisco on official business. Doctor Holmes will consider several features of the bureau work while in San Francisco, and may visit some of the important mining districts of California.

C. M. Derby for several years manager of the Natomas Consolidated, of California, operating dredges on the American River at Natoma, has resigned from that position and will be connected with the W. P. Hammon dredging interests in an engineering capacity. Mr. Derby resides at Berkeley.

L. D. Hopfield, who for some time has been assistant superintendent of dredge operations and construction at Natoma, Calif., has been promoted to general superintendent of the Natoma division. Mr. Hopfield has been employed by the W. P. Hammon interests in the dredging fields in the Yuba and Natoma divisions for several years.

William M. Tilderquist, who, for the past two years, has been superintendent of the Hibbing district west end mines of the Oliver Iron Mining Co., has resigned because of ill health, and will remove to Duluth. He will be succeeded by William F. Pellenz, who formerly held the position of superintendent of the Sellers mine.

Paul E. Morse, who has several years been employed as superintendent of construction of dredges operated by the W. P. Hammon dredging interests in California, has been promoted to the position of general superintendent of construction. Mr. Morse has superintended the construction of a number of dredges, the prominent ones being Yuba No. 13, and Natoma No. 10. The latter was put in commission at the end of September, and is the first all-steel placer gold dredge built and operated in California.

OBITUARY

J. D. Jordan, a well known mining engineer, of Kingman, Ariz., died last week at Los Angeles, Calif., where he had gone for treatment for cancer of the stomach.

James C. Loughead, one of the oldest citizens of Sarnia, Ont., died, Oct. 24, at the age of 72. He was born in Ireland, and, in 1860, settled at Oil Springs, Lambton County, Ont., where he was one of the pioneers in the oil-producing business. For over 40 years he operated in oil in various parts of Lambton County. He visited Australia in 1885, where he was engaged in sinking wells. He had been an invalid for some years before his death.

Maunsel White died at New Orleans, Oct. 22. He was born in Louisiana and graduated from Georgetown University, at Washington. He was well known as a metallurgist and was one of the inventors of the Taylor-White process of hardening and tempering tool steel. He was a close student of the methods of steel treatment and wrote several papers on the subject. At one time he was connected with the Bethlehem Steel Works, and took part in the sale of armor plate by those works to Russia. He was manager of the New Orleans Iron & Roofing Works. He was a member of the American Institute of Mining Engineers and of the Iron & Steel Institute.

Societies and Technical Schools

Iron and Steel Institute, Great Britain—The following changes have taken place on the council of the Iron and Steel Institute, consequent on the death of W. H. Bleckly, honorary treasurer: W. Beardmore, vice-president, has been appointed honorary treasurer, and J. M. While, member of council, has been elected a vice-president, to fill the vacancy thus created. Lord Airedale of Gledhow has been elected a member of council in place of Mr. While.

Society of Chemical Industry—The regular monthly meeting of the New York Section was held Oct. 25. The proceedings included an address on the life and work of the late Prof. Morris Loeb, by Prof. M. T. Bogart. James B. Douglas and J. F. Connor described the system of rendering aid to men injured, suffocated or overcome by noxious gases, as applied under their direction in the plants of the United Gas Improvement Co. They showed a pulmotor and demonstrated its operation, describing the results obtained in saving life.

Colorado School of Mines—The students of this school entered a series of mining floats in the industrial parade of the Mountain and Plain Festival, in Denver, on Oct. 15. There were 12 floats arranged in the logical sequence of mining operations, showing placer mining, the prospector's windlass, single and double hand drilling, machine drilling, hoisting with a 12-ft. headframe, sampling, assaying, stamp milling, coal mining and rescue and relief. The necessary machinery and teams were furnished by some of the large business firms of Denver, including Hendrice & Bolthoff Colorado Fuel & Iron Co., Mine & Smelter Supply Co., Morse Bros., Denver Fire Clay Co., the S. H. Supply Co., and others. The work of arranging and preparing the floats was done by the students under the direction of C. A. Allen, assistant professor of mining. A prize was awarded the exhibit.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Oct. 24—Within the last two or three years there have been several cases in the courts of California involving the right of ownership of lands that had in the early days been patented to the Central Pacific R.R. Co. A recent action brought in the superior court of Eldorado County, similar to other cases of the same character, will probably be compromised. The involved property is near Latrobe, eight miles east of Folsom and is known as the Catlin Ranch. The action was based on mining locations filed upon lands in Sec. 13 and 23, T-9 N., R-8 E., by the White Rock Land, Mine & Dredging Co. The lands had been passed to the Central Pacific R.R. Co. by patent and had been sold by the company to individuals. The plaintiff in the case, the mine and dredging company, had taken advantage of the clause reserving mining and mineral rights and claimed the right to file mineral locations upon the land. It was quite well known that mineral-bearing gravel underlaid the surface of the land, and under the strict ruling of the government the mine and dredging company was entitled to the claim of location of the mineral rights. The present possessors and occupants of the land, Jane Cothrin *et al.* held that the land had passed from the ownership of the railroad company, and is now vested in themselves as innocent purchasers, who have held undisputed possession for many years. They have paid the taxes estimated upon the agricultural value and justice to them would seem to give them the right to continue in possession. The court urged, when the matter was brought to trial, that the parties to the suit agree upon a compromise arrangement which would give to the occupants of the land some compensation for the taking over by the mine and dredging company of the land to which, under the strict construction of the act, the company seems to be entitled. The fact is quite apparent that the courts of California are not inclined to settle the matter of priority of right, and the litigants in such cases do not endeavor to spend the necessary money to carry these controversies to the higher courts. It is quite likely that this particular case will be settled by the payment of commensurate compensation to the defendant, and that the question of precise legal rights of either of the parties will not be settled.

Denver

Oct. 26—The coal-rate war between consumers and the railroads hauling coal to Denver from the northern fields (about 20 miles) was settled today by Judge Greely Whitford, of the district court, who sustained the railroad commission which ordered charges reduced. The decision, if sustained by the supreme court, to which appeal has been taken, means that the railroads may have to refund to shippers from $300,000 to $500,000 rebate for excessive hauling charges. But this is not the end, for if Judge Whitford's decision is upheld by the state supreme court, the railroads will take the case to the United States Supreme Court, the result being that the rates established by the commission's order two years ago may not become effective for at least five years, and that in the meantime no actions for reparation growing out of overcharges in the period in which the order has been in existence will be possible. Counsel for the railroads declare the rate fixed to be confiscatory, and that they will not stop until the United States Supreme Court has passed on the matter, both as to the power of the state railroad commission to make freight rates, and also on the reasonableness of the rates decreed.

At the annual meeting of the Colorado Fuel & Iron Co., the old board was reelected with one exception; S. G. Pierson, purchasing agent, was elected director, to succeed the late Edwin F. Hawley. During the year the gross earnings were $24,268,452, and the operating expenses $20,496,170. The total income from all sources, including the earnings of the subsidiary companies, was $4,448,974, while $2,647,746 were paid for taxes, interest and other charges, leaving a balance for surplus account of $1,259,672. With this addition, the surplus now is $3,060,900, which is more than double the amount needed to wipe out the deferred dividends on the $2,000,000 of preferred stock. These dividends were suspended in February, 1903, but last summer a payment of 5% was authorized, half being paid Sept. 1, 1911; and the other half is payable in February, 1913. The earnings are the largest in the history of the company.

The subsidiary companies holding their meetings were the Crystal River R.R. Co., Colorado & Wyoming R.R. Co., Rocky Mountain Coal & Iron Co., Colorado Realty Holding Co., Rocky Mountain Timber Co., Colorado & Wyoming Telegraph Co., Minnequa Cooperage Co., and Minnequa Land & Water Co. J. F. Welborn was elected president of these companies. The net earnings for the first quarter of the present fiscal year are said to be in excess of $1,000,000, and the Rio Grande, Burlington & Missouri Pacific R.R., which formerly purchased from the U. S. Steel Corporation, have placed large orders for rails with the Minnequa plant, at Pueblo, the unfilled orders being sufficient, it is stated, to keep it running at full capacity until next summer.

Butte

Oct. 23—For the purpose of developing the Cottonwood oil fields, 25 miles southwest of Billings, several Butte and Billings men have incorporated the Billings Oil Co. with a capitalization of 150,000 shares of $1 par value. The incorporators and directors are: L. Duggan, E. F. Murphy and J. J. McGreevy, of Butte; and J. G. Link, J. V. Dwyer, L. B. Woods and F. H. Rockow, of Billings. The company has obtained a large area adjoining the holdings of the Yellowstone Oil & Gas Co., which has been doing development in that territory for some time under the direction of H. J. Connolly, a well known oil man.

The stockholders of the North Butte Extension Co., which has holdings east of the Butte & Superior property, in the northern part of the Butte district, recently held a meeting at Portland, Maine, and elected as directors, Capt. A. B. Wolvin, N. Bruce MacKelvie, Keith Stewart, Arthur J. Ronaghan, C. W. Peters, E. L. Adams and David Agnus. The Butte & Superior Mining Co., of which Mr. Wolvin is president, and Mr. MacKelvie, a director, owns a controlling interest in the North Butte Extension Co.

A meeting of the members of the Butte miners' union was held, Oct. 20, at Butte, for the purpose of considering plans to assist the miners and smeltermen on strike at Bingham, Utah, and Ely, Nev. Mr. Lowney, who, with President Moyer, of the Western Federation of Miners, has had charge of the union men since the beginning of the strike, about a month ago, was present at the meeting, and spoke at length upon the situation, and appealed to the Butte union to aid the cause by a donation. A motion was made and carried that the members of the Butte union each donate the proceeds of one day's work, or $4, and the matter was left

to the result of a referendum vote. The balloting resulted in a refusal of the union men to assist the strikers.

Salt Lake City

Oct. 24—The situation at Bingham is rapidly improving. Operations are being resumed at more mines and the forces are being increased. Work has been resumed by the Utah Copper Co.; Eleven steam shovels are being worked, and more will be put in operation within a few days. About 11,000 tons of ore is being mined and shipped daily. Two more units have been added at the Magna mill, there being eight in operation. At the Arthur mill, nine units are being worked. Operations have been started at the Ohio Copper, with about 125 men. The Utah Apex began work, Oct. 21, with 25 former employees. The old Jordan and Telegraph mines, of the United States Co., have resumed operations with a large number of the old men. The Bingham Mines Co. has started work. The Jay Gould and Starless properties, owned by Col. E. A. Wall, began work Oct. 22. These properties announced that the increase of 50c. per day would be granted, but that the union would not be recognized. The Utah Consolidated began work Oct. 9, with men from outside, and recently some of the old employees have returned to work. The aërial tram between the mine and the Tooele smeltery is running, and up to 400 tons daily is reported to have been shipped. It is proposed to put on a night shift before the end of the week.

There is reported to be no increase in wages or recognition of the union at many of the properties, the Sept. 1 wage scale being in force. There are still some idle miners in the camp, and these have been given allowances by the Bingham Union No. 67, of the Western Federation of Miners. Married men draw $6 per week, and the unmarried $3.50. The strike is practically broken, and the men have lost. While some of the strikers are still "agitating," the operators express themselves as pleased with present conditions, and from all appearances things should be back to normal before long.

Globe, Ariz.

Oct. 21—Improved conditions in the copper industry are reflected in the increase in prospecting and mine development, and in general business, that has occurred in the last few months, and which is still continuing in the Globe and the Miami districts. The amount of freight hauled in by the Arizona & Eastern R.R. last month was nearly 40% greater than for the corresponding month of 1911, most of the increase going to Miami, seven miles west of Globe. The old McMorris and Irene silver mines are being reopened and many smaller copper and silver prospects are being developed.

There is a scarcity of labor in both the Globe and Miami districts, owing to the fact that natives of the Balkan states are leaving on every train to take part in the war.

An electric railroad, to connect Globe, Miami and the Inspiration Consolidated mines is a probability of the near future. N. L. Amster, president of the Shannon Copper Co., at Clifton, owner of the R.R.R. mine, at Patagonia, and who has extensive interests in Globe, including the Globe Light & Power Co., was in Globe last week in connection with the promotion of a company for building such a line. A franchise was submitted to, and approved by a meeting of, the citizens, and a committee was appointed to secure signatures to a petition to the board of supervisors, asking that a special election be called, at which the question of granting the franchise will be submitted to the voters of the county. Many citizens have agreed to take stock in the company if a franchise is granted.

Duluth

Oct. 25—Relative to the much discussed plans of the Hill interests and associates in the administration of their ore lands when released by the Steel Corporation, it is thought that the Pillsbury-Bennett-Longyear mines will be operated by their owners. These holdings, owned by Minneapolis men, comprise a good-sized fraction of the so called Hill lands, and were included in the lease to the Steel Corporation because of the close relations of their owners with the Great Northern interests. The Pillsbury-Bennett-Longyear lands under lease to the Steel Corporation are scattered from Chisholm to Coleraine on the Mesabi Range. One of the largest of the mines to be released is the property, one mile north of Keewatin, to be known as the Bennett mine, credited with an orebody of 40,000,000 tons. The Pillsbury-Bennett-Longyear interests, long identified only with the exploration end, are getting into the operating of mines. They have been operating the Pearce mine on the Mesabi, and recently formed the Cascade Mining Co., in conjunction with C. A. Smith, of Minneapolis, which has taken over the extensive lands of the Pittsburgh & Lake Superior Iron Co., in the Cascade district in Michigan. A mine is now being developed on these lands, and it is planned to develop two more where drilling has shown favorable results. In the Crystal Falls district, Michigan, a large ore deposit has been found on the Mastodon property by the Longyear company, and it is reported that this will be operated by a mining company formed by the Minneapolis men interested. O. B. Warren, of Hibbing, who has had charge of the fee interests of the Pillsbury-Bennett-Longyear lands, is gradually transferring this work to others, and is looking after the mining operations of the company. It is likely, if the Great Northern interests build furnaces to take care of their ore output, as it is rumored they will, that the Pillsbury-Bennett-Longyear mines will dispose of their product there.

The annual report of the mine inspector for St. Louis County, Minn., including the majority of the mines of the Mesabi and Vermilion ranges, shows that surface and open pit mining is more dangerous than underground work. The number of fatal accidents for surface mining during the last year was 3.83 per 1000 men employed; for underground mining, 2.69 per 1000 men employed. The total number of fatal accidents was 51, and the total number of men employed was 15,389, making 3.26 fatal accidents per 1000 men, both underground and surface, a reduction of 16% over the previous year. Of the 15,389 men, 7044 were employed underground, 2571 were employed on surface, 3200 were employed in open pits and stripping. The ore output from underground working was 10,624,147 tons; from surface workings 10,125,752 tons, making a total of 20,749,899 tons. For all classes of labor, the average wage paid per day was $2.60; the scale ranged from $6.66, the average wage paid to steam-shovel runners, to $2, the wage paid to change-house men and janitors. The reduction of 16% in fatal accidents and 35% in serious, non-fatal accidents, over the record of the year previous, is attributed to the enforcement of safety precautions and the installation of safety devices by the mining companies. All the larger companies now have rescue stations and crews trained by an expert in the use of the fire helmet and pulmotor.

Toronto

Oct. 25—The 60-day limit set for filing disputes against the applications for claims in the Gillies Timber Limit expired Oct. 21. Over 90 disputes have been filed and the hearings will require much time. To facilitate matters Mining Inspector E. T. Corkill, acting on the suggestion of Mining Commissioner Price, has made an inspection of some of the claims, as to discoveries, staking, etc.

The discovery of a rich gold-bearing quartz on an island in Nighthawk Lake has resulted in a rush of prospectors to that region, and many claims have been staked on the adjoining mainland. The discovery location is owned by Markey & Hyde, of Montreal, and through it passes an aplite dike from which the samples were taken, which crosses the narrow channel and reappears on the mainland, where it contains quartz stringers. All the claims staked are situated in Case township.

The Mining News

The Current History of Mining

Alaska

Excitement has been caused by a strike of rich placer gold on Boulder Creek, about five miles from Nome.

On Oct. 17 the U. S. Assay Office at Seattle received $300,000 in gold, $100,000 from Nome and the remainder from the Iditarod district.

The Copper River & Northwestern R.R. was reopened to Kennecott, Oct. 29, after suspension of service due to washouts attending floods.

Arizona

Greenlee County

Shannon—N. L. Amster says: "We are opening up a large area of ore 100 ft. below any point at which it has ever before been mined and are taking out ore averaging between 4 and 5% copper. We have proved the extension of the orebody to a point below the level of the Carter tunnel, which is a very important development. Production for September was below normal because of the freezing of one of the furnaces, and this month's production will also be smaller than usual, but is now increasing, and next month will show a decided increase. We have been doing considerable development work during the last six or eight months, and are now spending from $7000 to $8000 per month for that purpose, all of which is included in the operating costs."

Maricopa County

Vulture—No. 2 well has recently been drilled several hundred feet deeper, and the water supply for the mill considerably increased. The 20-stamp mill is running at full capacity, as well as the cyanide plant and concentrating tables, and it will not be necessary to build a pipe line from the Hassayampa immediately, although the line is being surveyed.

Max-Delta Mining Co.—This company, operating a mine seven miles south of Phœnix, has recently installed a hoist and compressor, and is sinking a shaft. Probably a pump will be required at an early date.

Kay Copper Co.—This company will use auto trucks for hauling ore; the contract with Tisdale & Lewis has been canceled. Active development work is being continued. There is some talk of building an electric line from Phœnix to the old New River stage station for the purpose of hauling ore from the mines in this and other districts to the railroad for shipment to the smelter.

Roosemoore—At this mine, 30 miles southeast of Mesa, there are five men at work taking out ore for shipment to the smeltery. The ore carries copper, gold and silver.

Mohave County

Boundary Cone Gold Mines Co.—The property of this company has been attracting local attention during the last year by rich strikes. Several weeks ago a shoot of ore was encountered on the 450 level west, which is now reported to be increasing in width and value as the heading advances. Samples taken over a width of about 16 in. gave assays of $150 to $200 per ton in gold. J. M. Vassar is superintendent. The mines are west of the Tom Reed mines, and in the same mineral belt. The development of the property to date consists of a shaft 475 ft. deep, 1318 ft. of drifts, 126 ft. of crosscuts and 30 ft. of winze. At present the shaft is equipped with a small gasoline hoist, capable of hoisting from a depth of 600 feet.

Arizona Venture Corporation—W. D. Grannis, president, recently put a force of men at work on the property, at Deluge Wash, in the Cedar Valley district. The company also owns a group of claims near the Tom Reed mines. B. F. Holcomb, a mining geologist, of Detroit, has just made an examination of both properties. It is the intention of Mr. Grannis to develop the Deluge Wash as rapidly as possible. A map was made of this group of claims and other data secured by Mr. Holcomb, and he has returned East to interest Easterners in the company.

Needles Mining & Smelting Co.—This company recently advertised for bids on sinking the Tennessee shaft from the 700- to the 800-ft. level. It is anticipated that the railroad spur will soon be completed to the mine and shipments of ore to the Needles smeltery will then be resumed.

Santa Cruz County

R. R. R.—N. L. Amster, who, with associates, purchased this mine several months ago, says: "We have just cut a new orebody, parallel to the one on which we have been working and 100 ft. from it, which is 23 ft. wide and averages between 8 and 10% copper, and we are now drifting on it. On the first orebody, two stopes from 70 to 80 ft. long, have been opened for a width of 40 ft. in ore that will run better than 10% copper. The winze is down 110 ft. and has 9% ore in the bottom. We are putting in a set of scales and by Oct. 20, will be shipping 100 tons per day of ore averaging between 8 and 10% copper, and this may later be increased to 150 tons per day. We are employing about 70 men."

Yuma County

Republic Smelting Corporation—This company has obtained control of copper claims, near Parker, and contemplates the erection of a smeltery. F. C. Fenner is president, J. A. Chestnut, manager, and A. L. Engledow, superintendent.

California

Amador County

The board of supervisors has agreed to grant rights of way and build the necessary bridges for the road connections with the state highway.

Plymouth Consolidated—The cleaning out of the Pacific shaft is about completed. At the 1950-ft. level an 18-in. vein has been disclosed, in which the ore assays about $9 per ton. On the level below this there has been discovered evidence of a raise started by the former operators, which indicates that this ore was known by them. The prospects are said to be good for the successful reopening of the mine. J. F. Parks, of Plymouth, is superintendent.

Butte County

Gold Bank-Golden Queen—The final payment has been made on the purchase price of these mines by the Forbestown Consolidated Gold Mines. The rebuilding of the old Gold Bank mill is completed; the shaft repairs are practically completed. The property was recently examined by C. K. Colvin, of Denver. It is not stated who the principals are, but should a sale of the property be consummated, the development and extraction of ore will be on an extensive scale, and the 20-stamp mill will be enlarged. M. J. Cooney, manager.

Calaveras County

Lightner—The company will be reorganized and fully provided with capital for more extensive development than has been caried on since the mill was shut down several months ago. It is the purpose to deepen the 1000-ft. shaft to 2000 feet.

Calaveras Engineering Co.—S. R. Fox, Louis Demartini and William Casey, officials of this company operating near San Andreas, have been convicted in the U. S. district court at San Francisco, of unlawful hydraulic mining.

Humboldt County

Rich surface quartz has been uncovered in the Willow Creek district at the base of Horse Mountain, where the recent new discoveries were made. It is reported that there is no present evidence that the pay ore goes deep, though numerous new locations have been made. Several prospectors have gone to the district. There is no good reason for a rush. The winter climate will not permit much development. Phillip McDonald, Alexander Dewar, R. Mitz and N. C. Halliday, of Eureka, are confident, however, that the camp will prove interesting in the spring.

Modoc County

Forest Service agents have located a site near Rattlesnake Butte, near Alturas, in which it is reported 50,000 acre-feet of water can be impounded.

Yellow Jacket—The Lucky Dutchman lease shaft is down 30 ft., and the new shaft house has been completed. The vein is reported to be about 18 in. wide. The lease has been acquired by A. L. Arnold; of the Spearmint Mining Company.

Modoc—A new shaft house is being erected by Shepard & Cook on a lease adjoining the town of Highgrade. A living house will also be erected.

Peterson—Winter supplies are being secured in order to carry on development work. Good milling ore is being extracted. Reynolds and Van Bellen, of Klamath Falls, Ore., are owners.

Sunshine—The main tunnel on leases 6 and 7 is being driven at the rate of one foot per day. The vein, which was formerly on the hanging wall, is now on the foot wall. Twin Leasing Co. is lessee.

Nevada County

Sultana—A new electric hoist and pump have been installed on the 800-ft. level. The compressed-air machinery formerly operating the hoist and pump will be used to operate the drills. The new hoist has a capacity of 2000 lb. at 1000 ft.; the pump has a capacity of 150 gal. per min. at 400-ft. lift. A new 150-hp. compressor will also be installed. Good milling ore is being extracted from the stopes and winze. The new pump and hoist were built by the Taylor Foundry & Engineering Co.

Oustomah—An electric plant will be installed in place of the water-power plant, including hoist, pump and motors for the operation of the compressors. The shaft will be deepened from 1050 to 1500 ft. Edward C. Klinkner is manager.

Golden Point—The shaft has been retimbered to 230 ft. and a new 1200-ft. hoist installed at this mine, near Grass Valley. Alfred Onn has a bond on the property.

Salmon—A steam hoist has been ordered for this mine, at Badger Hill. The grade of ore encountered is sufficient to encourage development. Charles Salmon is owner.

Arctic—The installation of electrical machinery, which has been hauled from Emigrant Gap with auto trucks, is progressing.

Plumas County

Droege—Ten stamps of the old mill have been reconstructed, and five are dropping. New stopes are being opened. W. E. Cahill, of Greenville, is superintendent.

Altoona—A 30-ton chilean mill has been installed for development milling. The shaft is 100 ft. deep and the drift on the vein has advanced to the 900-ft. point. A hoist will be installed. L. P. Wisewaid is superintendent.

Engle—The frame for a 7500-ft. tramway, extending from the mine to the 100-ton furnace recently installed, has been erected and is ready for the wire. The successful operation of this copper mine depends upon whether or not the smoke can be economicaly neutralized. W. Engle, of Taylorsville, is the manager.

Plumas Eureka—While this mine has recently been closed for lack of water, a small cyanide plant is operating on the tailings. D. J. Lawton, of Johnsville, is superintendent.

Siskiyou County

Wolverine—An electric plant will be substituted for the gasoline engine to operate the five-stamp mill, which is employed in developing the mine, at Anderson Ferry, on Klamath River. High-grade ore is reported in a crosscut run to find the walls. The property is owned and operated by Montana men. Mr. Rossman, one of the owners, is manager.

Siskiyou Mines Co.—The new 12-mile flume from the intake, on Thompson Creek, four miles above Nolton, to the hydraulic mines, is completed. The construction required 650,000 ft. of fir logs averaging 40 in. in diameter. The company formerly operated a mine on the wagon road from Happy Camp to Nolton. The plant of this mine has been removed to the present location, at Williams Point.

Tehama County

Deer Creek Power Co.—This is a new company, incorporated by Chico and San Francisco men, with capital stock of $50,000. The directors are: Martin Polk, C. L. Crowder, Park Henshaw, of Chico, and L. M. Fletcher, of San Francisco.

Colorado

Clear Creek and Gilpin Counties

Virginia City—Lessee Roberts, in this mine on Lincoln Mountain, has opened a vein of ore 10 to 16 in. wide which is stated to carry $145 per ton in gold and silver. He thinks he has a continuation of the shoot that in the early day produced ore worth as much as $300 per ton.

Idaho Bride—This company will take over the Seaton mine on the same vein as the Bride. This will give the company 3000 ft. on the vein. Connection will be made with the Newhouse tunnel which intersects the Seaton vein 1500 ft. below the surface, where a lateral has been driven 400 ft. on lead-zinc ore.

Frontenac Consolidated Gold Mining Co.—According to the report for August 5100 tons of ore was treated in the Black Hawk mill. The stope ore assayed $8.50 per ton; the development ore, $6; the latter being 770 tons of the total. Smelter returns for concentrate shipped, were $30,500; expenditures on revenue account, $18,500; net profit for month, $12,000 and expenditures on capital account, $7800; July profit was $8550. Sir Charles Allen, chairman of the board of directors, and Lieut-Gen. French, of the British army, are now at the mine near Central City.

Eagle County

Ohio Group—This group in the Mt. Egley district, D. H. Thomas, manager, will be worked all winter with five men in a crosscut tunnel now in 3100 ft. About 700 ft. of drifts and raises have disclosed fine gold and copper ore. The tunnel is to be driven 1500 ft. to cut several veins which make a good showing on the surface.

Lake County-Leadville

The zinc-carbonate ore lately opened in one of the Little Jonny shafts, is responsible for increased activity by lessees, on Breece Hill, and there are now but few shafts idle. Properties now working include the Penn, Chippewa, Little Bertha, Bobby Burns, Highland Chief, Eliza, Big Four shafts, St. Louis tunnel, Fanny Rawlings, Garbutt, Rattling Jack and Nevada.

American & Washington—These claims on Missouri Hill will be worked by Maupin Bros., who will sink shafts and then drive for low-grade, free-milling gold ore.

Sugar Loaf Consolidated—The output from the tunnel is about 20 tons per day of fair grade, and the breast which is being steadily carried into the hill is in good ore; 12 men are employed.

Adelaide—In a raise started recently by Peck & Sehrt, lessees, operating through the Yak tunnel, a good streak of ore has been opened.

Mandy May Mining & Milling Co.—Tests of the ore carrying lead, iron and copper from the tunnels on East Lake Creek, are being made by A. Y. Stubbins, manager, with a view to determine the best kind of separating machinery to install.

PITKIN COUNTY

It is reported that owing to the fire which has been burning for 15 years in the Smuggler, the mine and mill will be closed down until a 400-ft. drift can be driven around the bulkheaded fire zone. Rescue car No. 2 of the Bureau of Mines arrived at Aspen, Oct. 22, in charge of Prof. G. C. Roberts, who, with eight experts, will endeavor to extinguish the fire.

TELLER COUNTY-CRIPPLE CREEK

Mabel M.—The 12th level is now being developed and the grade of the ore is said to be even better than that mined on the eleventh. The shaft has been sunk to water level and a new drift will be driven from that point.

Midget-Bonanza Mining & Milling Co.—J. F. W. Doepke, president, is in the district and said to be investigating the local mills, looking toward the erection of a 100-ton cyanide mill to treat the low-grade ores from the dump and mine.

Mary McKinney—The regular quarterly dividend of 2c. per share amounting to $26,000, was paid Oct. 26.

Granite—This company has been especially benefited by the water recession in the Gold Coin shaft due to the deep drainage tunnel. The recession continues at the rate of six inches per day, with 8780 gal. per minute flowing from the tunnel portal. It will be possible to mine on the eleventh level in a short time.

Idaho

COEUR D'ALENE DISTRICT

The mines, on Nine Mile Gulch, are making extensive plans for next year, and already signs of increased activity are appearing. The Custer, the Callahan and the Puritan have increased their forces of men and have placed orders for new machinery. There are now 70 men at work at the Interstate-Callahan. A large number of these are at work on the new mill, which is being built. The work is being pushed as rapidly as possible, in order that it may be finished before winter sets in. The tramway leased from the Rex by the Tamarack-Custer company is nearly ready for use. The machinery orders placed by these mining companies are large. The Puritan company has ordered one 300-cu.ft. Ingersoll-Rand compressor and a 50-hp. Westinghouse motor. The Tamarack-Custer company has ordered one 1200-cu.ft. compressor and a 200-hp. Westinghouse motor. Also the machinery for a sorting plant, including two 9x15-in. Blake crushers, one Franz washing screen, shaking grizzlies and two picking belts. The Callahan company has ordered one 800-cu.ft. Ingersoll-Rand compressor and one 150-hp. Westinghouse motor. The machinery for the mill is being ordered from local firms. In the crushing end, there will be two 9x15-in. Blake crushers, two sets of 12x14-in. rolls and one set of 12x36-in. rolls. The fine grinding will be done in one 6-ft. Hardinge conical pebble mill. The tables will be the Wilfley and Franz models. Franz traveling screens will also be installed.

Silver Rock—This company has let a contract for another 100 ft. of tunnel, to be begun as soon as the present contract is finished. The tunnel is now in 275 ft. and has attained a vertical depth of 175 ft. The showing is continually improving as depth is gained, and some good samples of gray copper have been brought out.

Winter Lead—This company, operating property below Osburn, is considering the construction of a mill. The vein is extensively developed and is opened to a depth of 1200 ft. There is 4 ft. of good-grade galena ore. Two shifts of miners are employed and plans are perfected to continue the work throughout the winter.

Caledonia Mining Co.—During October 18,391 tons of ore mined returned $989,454 gross; $612,308 net. The net profit was $115,767 of which $52,100 was paid out in dividends. The ore was mined from the Omaha lease and from the Caledonia and O'Conner claims at Wallace.

IDAHO COUNTY

Elk City Mines Corporation—Manager J. T. Omo has announced that the company will at once begin the erection of a mill of 100 tons capacity to treat the ores from the South Fork mine. The present mill, consisting of five stamps, plates and one James table, has a capacity of about 12 tons daily. It is situated on the mountain side 700 ft. above the river. The new mill will be placed on the river. A hydro-electric plant to have an initial capacity of 125 hp. will be installed, which is expected to reduce the power cost considerably. The present power cost, using wood for fuel, is $510 per horsepower-year.

Moore Group—An English syndicate, represented by A. S. Burch, of Denver, has taken an option and working bond on this group of mines near Edwardsburg.

Gold King—Dan McRae, B. F. Goldman, and A. B. Lucas have sold the Gold King and Gold Queen claims adjoining the Eagle mine, to Salt Lake men for $150,000. Supplies are being shipped to camp in order that work may be continued all winter.

Ex-Ray—A rich strike was made at this mine in the Florence district. Three feet of free-milling ore assaying $200 per ton was opened in the new crosscut.

Michigan

COPPER

Allouez—Shipments of about 1500 tons daily are going to the mill, about 600 tons of this amount being supplied from No. 2 shaft. Nine-ton skips are in service and the entire equipment is satisfactory. Production is on the increase and the ore contains more than 16 lb. of copper per ton.

Mayflower—No. 22 drill has encountered a copper-bearing formation at a depth of about 1024 ft. which is over 80 ft. through and is well mineralized. Results of the drilling have shown the formation to be faulted, but the results are being carefully platted and it is probable that sufficient data will be obtained in the near future to warrant the management to proceed in shaft sinking.

Calumet & Hecla—This company has installed an electrically driven centrifugal pump of about 1000 gal. per minute capacity at the 600-ft. level of the Red Jacket shaft in the crosscut that was driven a few years ago to open the Pewabic lode. The construction work at the stamp mills is going on satisfactorily, being materially aided by the exceptionally fine weather that has prevailed for the last few weeks. The steel work at both the power plant addition and the new regrinding plant has been completed and the building has been inclosed. The company is building the tube mills and other apparatus to be used in this mill.

IRON

Munro—This low-grade mine, of Rogers, Brown & Co., at Norway, has been closed for the season, after shipping about 20,000 tons of ore. Most of the men were transferred to the Rogers mine, at Iron River.

Buckeye—At this mine, of Oglebay, Norton & Co., at Commonwealth, Wis., a steam shovel is being used to ship from the stockpile, although the underground workings are idle.

East Norrie—At this mine, of the Oliver Iron Mining Co., at Ironwood, a large hoisting shaft is being sunk, which will eventually replace the old "C" shaft. The shaft will be lined with steel and concrete, and several years will be required to finish the work.

Cascade Mining Co.—A geared hoist has been received from the Imperial Iron Works, in Duluth; a six-drill air compressor from the Ingersoll-Rand Co.; two Kewanee boilers, and two smokestacks. This equipment will be used in sinking the shaft. The shaft is about 30

ft. in rock, and has gone through the Goodrich quartzite into diorite. The shaft will be concreted for 60 ft., 20 ft. of which will be in surface soil. It was found necessary to concrete into the rock which is altered and broken. The office building has been completed, also the temporary dry-house. A temporary engine and boiler house is being erected east of the shaft. This building will have space for a third boiler, to be installed later if necessary. The permanent buildings, to be erected later, will be of concrete, and will be situated on the hill north of the shaft. A survey has been made for a branch railroad from the Chicago & Northwestern Ry., which passes near-by, and which will be built next season.

Minnesota

Cuyuna Range

Cuyuna-Mille Lacs—The Cuyuna Northern Ry. tracks have been extended to this property, and five cars of manganese ore have been shipped to the furnace, at Ashland, Wis. The rich manganese ore was found on the 126-ft. level of this mine, and drill records show it to be 420 ft. deep. The company expects to ship six cars per week all through the winter.

Mangan Iron & Steel Co.—A. F. Gross, president of this company, which is developing iron and manganese properties, states that at the No. 1 property, which adjoins the Cuyuna-Mille Lacs, manganese ore extends clear across the "forty." The ore assays from 8 to 30% manganese. The No. 2 property adjoins the Armour No. 1 on the north. It is essentially an iron-ore property, but assays as high as 11% manganese.

Mesabi Range

The mines of the Hibbing district are still making heavy shipments, and it is expected that it will be possible to continue until well into November.

Madrid—The Virginia city council is discussing the question of attempting to prevent A. B. Coates, who is operating this property, from mining under the streets, claiming that there is danger of the streets caving.

Section 30 Mining Co.—This company recently cleaned up its stockpile. Shoveling was begun late in June and 150,000 tons of ore has been shipped. Of this ore 50,000 tons was purchased by the Zenith Smelting Co., and all but 10,000 tons has been delivered.

Zenith—The Oliver Iron Mining Co. stockpile, at this mine, is nearly cleaned up. Up to Oct. 15, 180,000 tons of ore had been shipped.

Pioneer—About 15,000 tons of ore remains in the stockpile. It is expected that all of this ore will be disposed of before the season closes.

Montana

Butte District

Tuolumne—The shaft is now 2000 ft. deep and a station is being cut at this level. Sinking is going on steadily with the intention of going to the 2800-ft. level. Stations will be cut and development started on the 2000-, 2200-, 2400-, 2600- and 2800-ft. levels. The ore on the 1800-ft. level does not contain as much copper as that on the 1600 ft. level, corresponding in this respect to the North Butte and other adjacent properties, which passed through a lean zone at about the same depth. It has been proved, however, that below this zone the copper tenor is greater. About 75 tons of first-class ore mined between the 1400-, and 1600-ft. levels, and a like amount of second-class ore mined on the 1800-ft. level, are being shipped daily.

Cascade County

Fair Play—At this mine near Neihart a drift recently opened one foot of ore assaying 82 oz. of silver per ton. The mine adjoins the Broadwater mine, which has produced over $3,000,000, and is traversed by the same vein. A tunnel being driven into the Fair Play, has reached a depth of 250 feet.

Deer Lodge County

Southern Cross—The new machinery ordered for this Georgetown property of the Anaconda Copper Mining Co. has arrived at Silver Lake, and as soon as the remaining 1½ miles of rails of the new railroad being built into the camp have been laid the machinery will be transported to the property. The electric-power line from Flint Creek Falls to the mine is rapidly nearing completion, and as soon as the power can be utilized operations will be started on a large scale. In anticipation of this the force is being augmented from day to day.

Fergus County

Kendall—This famous gold mine has been worked out and closed after 13 years of continuous operation, during which time dividends to the amount of $1,425,000 have been paid. H. T. Kendall purchased the claim in 1899 for $650, and soon after bought the Klondike claim adjoining for $1500. Operating in a small way, he shortly opened a large body of ore. In 1900 Finch and Campbell, of Spokane, purchased the property for $400,000 and have operated it since then at a profit of more than $1,000,000.

Whiskey Gulch—Eastern men, organizers of the Boston Mining Co., are taking steps to acquire this property near Gilt Edge. It has been worked intermittently for several years and some high-grade gold ore has been mined. Nearly $250,000 has been expended for the erection of a mill, and development of the mine. Several companies have undertaken to operate the mine, but all were forced to suspend operations for the lack of funds for systematic development work. The new company will pay off a few judgments standing against the property, and then begin a thorough campaign of development.

Jefferson County

Mount Washington—During recent weeks the output of ore from this property, consisting of six claims near Wickes, has been in the neighborhood of 50 tons per day. The shaft is now 200 feet deep and plans are being made to sink deeper.

Lewis & Clark County

Piegan-Gloster—The Barnes-King Development Co., which recently purchased the Piegan-Gloster mines in the Marysville district from the judgment creditors of the Piegan-Gloster Consolidated Mining Co., has paid $25,000 on the purchase. The price of the property is $125,000 in deferred payments extending over two years; or in the event the company decides to pay the debt by next March, a saving of $25,000 will be made. It is probable that this will be done. Crosscutting to the orebodies is being done as fast as possible.

Madison County

Blowout—The Corbin Copper Co., operating a copper mine in the Corbin district of Jefferson County, recently took over the Blowout mine in the Rochester district. The shaft has been unwatered, and a crew of men is now engaged in sinking to the 300-ft. level. When this depth is reached, crosscutting to the veins will be started. T. A. Varden, superintendent of the Corbin Copper Co., is preparing to move his office from Corbin to Rochester.

Nevada

Comstock Lode

Hale & Norcross—The lessees have shipped two railroad cars of average-grade ore to the smeltery.

Crown Point—Milling continues at the Yellow Jacket mill, and 661 tons was treated recently in one week. The gross production of the mine was 515 tons, assaying about $4000.

Ophir—The new cyanide plant is being operated three shifts per day, excellent results being obtained. Adjustments, of course, have to be made, but the entire plant is running smoothly.

Union Consolidated—On the 2500-ft. level, the west crosscut, just south of the north boundary line, has cut through quartz stringers, but surveys show that the heading is east of the point where the rich oreshoot, recently cut in the Sierra Nevada, might be picked up.

Mexican—The ore extraction in a recent week was the greatest so far made from the stopes, 624 tons giving a gross assay of $41,000. Of this production.

530 tons was taken from the stope on the 2500-ft. level, and averaged $71 per ton. This is the largest week's production ever taken from the deep levels of the Comstock, the bonanzas all being on the upper levels. The mill treated 451 tons, of a gross assay value of $22,707. The new tube mill has been installed and placed in operation.

Sierra Nevada—A north drift has been started on the vein that was cut last week by the crosscut from the 2500-ft. level, and the advance made shows that the vein is steadily widening. A recent report shows that the fissure is 5 ft. wide, with 2 ft. of solid quartz, and 3 ft. of a mixture of porphyry and quartz. In the top, a foot of rich ore is coming in. The ore was carefully segregated, and considerable specimen ore saved from seven inches that sampled close to $1000 per ton. One car ran $50 per ton, and another was of milling grade.

Eureka County

Mt. Hope Mines Co.—This property, which was worked 30 years ago, when the Eureka smelteries were running, is now being operated by W. B. Gillingham and Edward Whittmore, the owners.

Eureka Windfall Mining Co.—This company is operating its remodeled mill, treating 100 tons of ore per day.

Diamond Mines Co.—This property has recently been closed down.

Credo-Eureka Mining Co.—A little development work is being done at this property.

Lander County

Austin-Manhattan Consolidated Mining Co.—William A. Marshall, receiver for this company, will sell its real and personal property at auction, in Austin, Nov. 18, 1912. The liabilities exceed $90,000.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended Oct. 19, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,550	140,969
Tonopah Belmont	3,576	101,680
Montana-Tonopah	993	43,378
Tonopah Extension	1,066	42,073
West End	850	31,872
Midway	.....	670
MacNamara	465	15,539
North Star	48	266
Mizpah Extension	.....	40
Jim Butler	300	2,800
Totals	10,848	379,287
Estimated value	$271,200	

The total output of the Tonopah mines for September was 43,530 tons.

Tonopah Mining Co.—The report for September states that 14,806 tons, averaging $18.77 per ton, was milled for a net profit of $154,073.

Tonopah-Merger—The railroad spur to the ore dump has been built, ore bins are being built, and shipments will commence in a few days. Stopes are being opened on the 980-ft. level, where the west drift shows 6 ft. of ore, averaging $110 per ton. The west drift on the 1060-ft. level shows 6 ft. of ore, averaging from $50 to $80 per ton.

North Star—A second shipment has been made of 48 tons of ore from the 850- and 1250-ft. levels that, it is estimated, will return over $100 a ton.

MacNamara—The clean-up for the first half of October produced 1000 lb. of bullion, valued at $12,000.

Tonopah Extension—The clean-up for the first half of October produced 2385 lb. of bullion, valued at $27,300.

Pittsburgh-Silver Peak Gold Mining Co.—The report for the six months ended June 30, states that gross earnings were $613,883 and net profits $146,743.

Dexter White Caps Mining Co.—Lessees on this Manhattan property have milled 6168 tons for a gross production of $176,948. The mill is treating 50 tons of ore daily.

White Pine County

The strike in the Ely district has been called off, and the operators have refused to recognize the union. The Nevada Consolidated started two steam shovels at Copper Flat, Oct. 24. By Oct. 25, 4000 tons of ore was shipped to the Steptoe smeltery, and it has been predicted that shipments will be about normal within a fortnight. Because of the strike, it is unlikely that Nevada Consolidated will this year pay an extra dividend, as was rumored some time ago.

Oregon

Lane County

Lucky Boy—Porter Bros., railroad contractors for the Southern Pacific, let their option on this property expire. It is owned by Portland, Ore., men, who will soon start up the mine and mill. There is a power plant on the property, and it was thought that the Southern Pacific wanted the property for the power.

Reed—J. V. Reed, of Eugene, Ore., owner of this property, will install milling equipment and develop the property this winter. He states that he has made arrangements for treatment apparatus with the Gold & Platinum Extraction Co., of Los Angeles, Calif., and that he will use their chemical process for the treatment of sulphide ores. The equipment consists of redwood tables and tanks, but the manner of using them is not made public.

Treasure—Dan McAllen, of Portland, Ore., with some other Portland men, has just secured the controlling interest in this property, and will commence active work soon. The machinery is all installed, and although the property has been idle for several years, the plant and mine are in good condition.

South Dakota

Lawrence County

Trojan—This company is adding one of the most complete machine shops in the Black Hills district to its equipment. The building has been completed. The machinery has been delivered, and is now being installed. The company has recently put in operation the second gasoline locomotive, manufactured by the Milwaukee Locomotive Works. The first was described in the Journal of Sept. 30, 1911. These locomotives are operated over a track a little more than a mile in length, having a 4% maximum grade. The regular load is 11 or 12 one-ton loaded ore cars. They have pulled as many as 22 loads, but this is considered excessive. The mill is being operated steadily at a capacity of about 175 tons per day. It is planned to increase the capacity to 400 tons daily next spring.

Golden Gate—A crew of men is rapidly getting the shaft in shape for operation of the electric hoisting plant, which will be installed.

Homestake—Royalty payments to C. W. Merrill have ceased, his final contract, which covered the slime plant, having expired Aug. 12.

Mogul—Shipments of about 75 tons per day are being made from the Lucille mine of this company to the Lundberg, Dorr & Wilson mill, at Terry. Lessees are operating at two or three other places. Leases have also been given to allow the lessees to secure what gold they can on the site of the two mills, which were destroyed by fire. One of the mills was located at Terry and the other at Pluma.

Wasp No. 2—This property is operating at its usual rate. Dividend for October was 2c. per share, or $10,000. New steel zinc-boxes have just been installed in the precipitation room.

Utah

Juab County

Tintic shipments for the week ended Oct. 18 amounted to 170 cars. There has been a car shortage to some extent, caused by the hauling of sugar beets, and other traffic at this season.

Mammoth—The copper ore opened from the 600-, 700- and 800-ft. levels has been followed above the 600 and it is thought from the present showing that it may continue through to the upper levels. Driving is being done on the 400, toward where this ore is expected. About 300 ft. more work will be required to reach this ground. Nearly 5000 tons of dump ore has been shipped recently.

Iron Blossom—Lead-carbonate ore has been opened above the 500 level of the No. 1 workings. Two raises are being cut for this ore, which is about 180 ft. above the level. Copper ore has been

opened on the 600 in the No. 3 workings, and a winze is being sunk on this ore. The copper ore is the first found in the north end of the Iron Blossom.

Yankee—Prospecting is being done from the west drift of the 1800-ft. level, the work being almost directly underneath the old workings from which zinc ore is being mined. New zinc ore has been opened during the last few weeks, and about two cars weekly are being shipped.

Swansea—An old winze sunk 65 ft. below the 940-ft. level has been cleaned out, and work will be continued here, as soon as a donkey-engine can be installed.

Beck Tunnel—Thirty tons of ore is being shipped daily. The company is more than meeting expenses.

Opohongo—Steady shipments are being made, and earnings are stated to be in excess of dividend requirements.

East Tintic Development — Lessees have recently shipped a car of zinc ore.

Tintic Smeltery—Two cars of ore that have been stored in the bins since the time of the closing down of the smeltery were shipped the week ended Oct. 18.

Salt Lake County

Ohio Copper—Operations were resumed Oct. 15 at the mine, and one section of the mill has been started.

Utah Copper—The output for September was cut down nearly half on account of the strike. The production was 6,965,144 lb. of copper, as compared to 11,248,992 lb. in August, and 10,602,000 lb. in July. The production for the quarter was 28,816,136 lb. Eleven of the 22 steam shovels were at work Oct. 24.

Michigan-Utah—All arrangements of buildings and surface equipment for the winter have been made, and shipments are being made over the new tramway; 100 tons was sent down, Oct. 16. About 35 men are working on leases at the City Rocks end of the property. A visit of inspection was recently made by the directors.

Alta Consolidated—Surface improvements are being made, including new quarters for the men. M. J. Dailey, formerly surperintendent at the Silver King Coalition, at Park City, has been elected a director, and E. A. Culbertson has been chosen treasurer.

South Hecla—Operations with a full force of men have been resumed at this property.

Intermountain Transportation — Articles of incorporation have been filed by this company, which has been organized to provide transportation facilities for any camps or mines, that can afford a sufficient tonnage. Several motor trucks are stated to have been ordered. F. V. Bodfish is president.

Canada

Ontario

Strathcona—The Canadian Copper Co. has relinquished its option on this nickel property after drilling eight holes. It is in the township of Levack, adjoining the Levack mine. The owners of the Strathcona will continue drilling this winter.

Murray—Seven drills are now at work on this mine, recently purchased by the Dominion Nickel-Copper Co. It is reported that large ore reserves are being opened on an extension of the orebody to the northwest. Smith & Travers, of Sudbury, are doing the drilling for the company.

Tam O'Shanter—The Canadian Copper Co. will commence drilling on this property, on the South Range, east of its Creighton mine.

North Star—The Mond Nickel Co. is planning to reopen this mine, which has been closed for several years. It adjoins the Creighton on the east and has yielded some rich ore.

W. D. 38—This lot, on the North Range, is being developed by Messrs. Laforest and Bennett, of Sudbury. The same men are doing some work on Clear Lake, at the east end of the district.

Ontario—Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Oct. 25, and for the year to date, were:

Bailey		21.57
Beaver		299.38
Buffalo		989.50
Casey Cobalt		255.15
City of Cobalt		887.99
Cobalt Lake		739.55
Cobalt Townsite	117.25	1,579.40
Chamb.-Ferland	32.80	395.13
Coniagas		1,673.95
Crown Reserve		388.21
Drummond		383.05
Hudson Bay		569.32
Kerr Lake	60.40	651.17
La Rose	32.60	2,907.68
Lost and Found		27.80
McKinley-Darragh	44.22	2,182.72
Nipissing		1,704.50
O'Brien		560.64
Penn.-Canadian		63.45
Provincial		22.22
Right of Way		242.82
Timiskaming		893.71
Trethewey		447.79
Wettlaufer		346.45
Colonial		63.14
Dominion Reduction Co		56.64
Totals	287.27	18,352.93

Cobalt Townsite—One hundred and twenty men employed by this company went out on strike, on Oct. 19, on being refused a reduction of the working hours from ten to nine per day.

Wettlaufer—A report for the quarter ended Sept. 30, shows that 4765 tons was milled, producing 195,273 oz. of silver, worth $125,841. The expenses were $48,444, leaving profits of $77,396. Fred Hellman, consulting engineer, reports that as 658,647 oz. of silver had been extracted in the first nine months of the year, the silver in sight at the end of September was about 341,300 oz., and that unless further discoveries of ore are made in the near future, the present rate of dividends cannot be maintained much longer.

Pan Silver—This mine will be unwatered and operations resumed, the management having decided to mine on deep levels.

Crown Reserve—A new branch of the Office vein has been encountered in a crosscut on the 200-ft. level. It shows 2 in. of calcite and cobalt and is reported to assay 3500 oz. of silver per ton.

Kissinger—A plant has been ordered for this property, in South Lorrain, where the shaft is now down 100 ft. The vein dipped out of the shaft at a depth of 50 ft. and development will be undertaken at the 100-ft. level to pick it up.

Ontario-Porcupine

Hollinger—Since the commencement of operations this mine has shipped a total of 29 bars of bullion of the value of $464,000.

McEnaney—The main shaft is down 415 ft. and a station has been cut at the 400-ft. level. The rich vein cut at 200 ft. has been picked up on the 100-ft. level.

Vipond—C. H. Poirier, manager, has returned from a visit to New York and Toronto and has secured data which will determine the type of cyanide plant to be installed, as experience has shown that amalgamation does not give a sufficiently high recovery.

Tough Claims—In the course of development on these claims, in the Swastika district, two more rich, but narrow veins have been discovered.

Dixon—A large hoist is being installed at the No. 9 shaft. When this work is finished, underground operations will be resumed on a large scale.

Dome—On account of water shortage in Simpson Lake, this company finds it necessary to put in a new pipe line to Porcupine Lake, about 2½ miles distant.

Mexico

Sonora

Lucky Tiger-Combination Gold Mining Co.—During September, ore, concentrates and bullion were produced of a total realizable value of $85,620; net profits amounted to $27,888. In the old mill, which was in operation 61% of the time, 1500 tons of ore was crushed; the stamp mill was in operation 75% of the time, crushing 2767 tons of ore. The cyanide plant treated 4150 tons of current and 1125 tons of dump tailings. The low profit for September was due to the effects of the presence of bandits in the vicinity of the mine, as the metallurgical results were better than in any previous month.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Oct. 30—The coal-trade situation in the West is not improving, and better conditions are hardly expected for a month yet. The closing of the Lake trade will then release a number of cars, which can be used in the general coal trade.

The Seaboard bituminous trade is still active, with prices strong. Supplies are a little better, but the coastwise trade is calling loudly for coal.

The anthracite companies are slowly catching up with demand, but the trade is still behind on deliveries to consumers. Some sizes, both domestic and steam, are scarce.

United States Fuel Imports—Imports of coal and coke into the United States, eight months ended Aug. 31, long tons:

	1911	1912	Changes
Anthracite		30	I. 30
Bituminous	844,959	1,025,388	I. 180,429
Coke	51,225	61,156	I. 9,931
Total	896,184	1,086,574	I. 190,390

Canada furnished this year 916,453 tons coal and nearly all the coke; Australia, 84,554 tons coal; Japan, 18,616 tons coal. Imports are nearly all on the Pacific Coast and in the far Northwest.

United States Fuel Exports—Exports of coal and coke from the United States, with coal furnished to steamships in foreign trade, eight months ended Aug. 31, long tons:

	1911	1912	Changes
Anthracite	2,294,005	2,186,330	D. 107,675
Bituminous	8,642,859	9,668,352	I. 1,025,493
Coke	651,450	556,583	D. 94,867
Bunker coal	4,406,351	4,943,257	I. 536,906
Total	15,994,665	17,354,522	I. 1,359,857

Canada took this year 8,836,946 tons of coal; Cuba and the West Indies, 1,238,045 tons; Panama, 312,227 tons; Mexico, 224,561 tons.

Iron Trade Review

New York, Oct. 30—The iron and steel trade continue in extremely active condition. There has been, however, less talk of advancing prices, and quotations have, for the most part, been stationary.

There has been a decrease in buying of steel products for far-forward delivery, although it is difficult thus early to determine the cause of the decrease. In specifications against contracts there is also a decrease, as compared with 30 days ago, but the tonnage being specified is still very large.

There are two distinct markets in many steel products, the prices at which the larger mills will sell, if they sell at all, and the higher prices at which smaller mills will sell for early delivery. As to the lower range of prices, the prediction is now made that there will be no further advances for some time, or until the future can be more clearly seen. A couple of exceptions are made in this prediction, referring to shafting and tinplates, which may be advanced $2 a ton within the near future.

The scarcity of unfinished steel is increased, and there are practically no offerings from any quarter for the balance of this year, while the mills adhere to their recent declarations that they will not open their books for first quarter, being already oversold with the heavy requirements of their own finishing mills and their regular long-term contracts for billets and sheet bars, against which consumers are specifying the maximum tonnages allowed. It is becoming more and more clear that barring accidents some of the independent finishing mills will not be able to run full in the early months of the new year. The loss of production may be small in proportion to total tonnage, but it is a striking fact that there should be finishing capacity idle when the market could absorb its product.

Buying of pig iron has been heavy, the demand for foundry and basic pig being insistent. It does not seem to be at all discouraged by the advances which most furnaces are asking on new contracts. The coke situation seems to be a little easier, but it is still a question whether further expansion in iron production is possible without a larger supply of fuel.

United States Steel Corporation—The statement for the quarter ended Sept. 30, gives net earnings after deducting operating expenses and ordinary renewals, as follows:

	1911	1912
July	$8,750,467	$9,322,142
August	10,710,145	10,583,377
September	10,062,113	10,157,993
Quarter	$29,522,725	$30,063,512
Depreciation, sinking fund, etc.		$9,286,047
Interest on bonds		5,683,964
Total charges		$14,970,011
Surplus for the quarter		$15,093,501
Dividends paid		12,658,700
Balance		$2,434,801

The usual dividends of 1¾% on preferred and 1¼% on common stock were declared. The total net earnings for the nine months ended Sept. 30, were $72,992,800, which compares with $81,150,448 for the corresponding period last year. The decrease shows the effect of low prices.

Baltimore

Oct. 28—Imports for the week included 793 tons ferromanganese from Liverpool; 480 tons ferromanganese from Rotterdam; 250 tons steel scrap from London; 5336 tons manganese ore from Batum, Russia; 24,700 tons iron ore from Cuba.

Birmingham

Oct. 28—Southern pig-iron manufacturers are selling their product right along but not to any extent beyond the first quarter of 1913. The quotations are on a minimum of $14 per ton, for No. 2 foundry, with $14.50 per ton asked for next year. Some companies are selling at $14.50 for delivery during the first half, while others are not selling at all for the second quarter, preferring to wait. Efforts are being made to make full delivery on orders received some time ago and as far as can be learned there is little, if any delay. Another blast furnace has been put in operation in Alabama. The home consumption promises to be active throughout the coming year.

Following an announcement a few weeks ago that two additional pipe plants are to be erected at Anniston, Ala., the formal organization of a new pipe company with practically all local capital has been perfected in Birmingham and a plant will be erected during the next 12 months at Boyles, just outside Birmingham. Machine shops and foundries continue busy with prospects of a steady run through the Winter and Spring at least.

It is given out officially that orders are in hand that will warrant the operation of the Bessemer rolling mills steadily for several months. The Tennessee Co. owns the Bessemer mills. The big steel plant at Ensley will most likely break some records as to output during this month.

Charcoal iron still sells at $22 and over with the production about equal to the demand. Scrap iron is in good demand with plenty of stock to meet the demands.

Chicago

Oct. 29—Sales of pig iron continue moderate and prices are firm; the demand for iron and steel products makes the

market for them active; a flood of orders pours in constantly and presses hard on the productive capacity of the mills. With all this promise of future as well as present business, pig-iron sales continue only moderate. Many of the larger melters are well covered for their requirements of the first half; others are buying for that time in small lots; no sales have been made beyond the first half, though some inquiries are coming in.

Southern No. 2 foundry iron holds to $14@14.50, Birmingham, which means $18.35@18.85, Chicago. Northern of the same grade sells at $17@17.50, furnace, making the delivered cost about $17.50@18. In general, the pig-iron market seems strong and the aggregate of orders maintains a good tonnage showing each week. Lake Superior charcoal iron is in good demand at $17.75@18.25 on deliveries to the end of the first quarter.

The finished-material market is everywhere strong. Railroad supplies are being very largely bought, rail orders being numerous and for large tonnage. Structural material is sought to such an extent that mills cannot supply the demand, for first-half deliveries, advances in prices seeming to have no effect on the demand. Bars likewise suffer no check from higher prices and the problem is to obtain the material in time. Sheets and plates are hard to get for first-half delivery and minor lines show a similar pressure on the producers.

Cleveland

Oct. 28—Lake ore movement is very heavy and it looks like an unprecedented tonnage in October.

Pig Iron—Sales continue large, and prices firm, with an upward tendency. Bessemer pig is quoted $17.90 and No. 2 foundry $17@17.25, Cleveland delivery.

Finished Material—The main feature is the pressure on the mills for deliveries. On new orders, especially for bars, plates and structural steel, it is hard to get definite assurances as to time from most mills. Structural steel is especially in demand.

Philadelphia

Oct. 30—Prices are advancing slowly in all kinds of pig iron, due largely to the heavy purchases of crude and semi-finished steel. Inquiries have increased during the past week for next year's delivery as late as summer. Basic has been particularly active in large lots and the inquiries now pending indicate that consumers are anxious to supply remote wants. There are some intimations that the topmost level of prices is in sight, but this gratuitous inference is not supported by any reasonable evidences in sight. The buyers of foundry iron have been piecing out in small lots. The demand for forge is heavier than for months and will probably continue, as the mill people have not covered forward requirements to the extent that has been done by other consumers. Outside prices for No. 2 X foundry are $18.50; No. 2 plain, $18; forge, $17.50; basic, $18; low-phosphorus, $23.50 per ton.

Billets—Billets are in active demand once more, at $30 for rolling, and a good business is now in sight.

Bars—Refined is in active demand at 1.60c., delivered in small lots, and newcomers are facing higher quotations and the difficulty of getting iron delivered when they need it. Common iron is more active than for months.

Sheets—Sheets have advanced in many cases as much as half a cent, and even a further advance for forward deliveries is in sight. Blue annealed sheets are quoted at 1.80c. as a minimum.

Pipes and Tubes—Delayed shipments of tubes have caused some inconvenience. Merchant pipe has been advanced.

Plates—It is difficult to give quotations for plates. The requirements crowding in from day to day are causing the makers much concern. About 1.75c. is the nearest safe price for early delivery. Much business is done at 1.60@1.65c., where some liberty is accorded as to deliveries.

Structural Material—The volume of business in structural material is heavy at 1.65@1.75c., according to delivery, and inquiries are presented for large supplies for first and second quarters.

Scrap—Recent heavy dealings have practically cleaned out all the available scrap of the higher grades, and even in the lower grades stocks are smaller than they have been for months.

Pittsburgh

Oct. 29—Pressure upon steel mills for delivery is unabated, and in lines like bars, plates and shapes this is forcing an increasing tonnage of new business to the smaller mills, which did not fill up, and can, therefore, make early deliveries, at prices ranging from 1.60 to 1.80c., Pittsburgh. The regular market, for far-off delivery, is quotable at 1.40c. for bars and 1.50c. for plates and shapes. The Steel Corporation, however, which has evinced a disposition lately to curb the advancing tendency, is quoting from 1.40@1.45c. on plates and shapes, but it picks its customers very carefully. It has figured largely in the sale of material for the large car orders placed this month, at 1.40c. for plates, which gives the car shops the concession from open-market prices, to which they consider themselves entitled. Car orders placed in October total about 30,000, a quantity almost equal to the orders placed during all of the three preceding months. At their present rate of operating, about 60% of capacity, the car shops are now easily filled through the first quarter of the new year.

Pig Iron—Sales of bessemer iron aggregating over 40,000 tons have been put through, at $17, Valley. These include one lot of about 5000 tons a month over the first half, and other lots of about 10,000 and 5000 tons, for delivery during the first half. Sales of basic iron have been made at $16.25, Valley, 5000 tons for first quarter and 2500 tons for second quarter. This establishes the market, which had been quotable roundly at $16@16.25, there having been sales at $16, followed by one or two reported at $16.15. Foundry grades have been quiet, it being hard to arrange deliveries, with furnaces already behind, while buyers have been less keen since the sharp advances. Occasional small lots have gone at prices above the regularly quotable market. We quote: Bessemer, $17; basic, $16.25; foundry, $16.50@16.75; forge, $16; malleable, $16.25@16.50, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The contract market is strong at $61, Baltimore, for 1913 delivery, freight to Pittsburgh being $1.95. Prompt lots are very scarce indeed, and are quotable in general at $70@75, Baltimore, with very little material available. Consumers are very well covered on contracts, but are not getting good deliveries.

Steel—There is no prospect of any loosening up in the supply of billets and sheet bars for months to come. Consumers are ready to buy for first quarter, but cannot find any sellers. For early delivery some steel could be sold, though possibly no large tonnage, but there are practically no offerings, and it remains a question between producers and consumers of deliveries on contract. These are fairly satisfactory, but occasionally production is lost by finishing mills through inadequate shipments. We continue to quote the market as follows, though prices are necessarily largely nominal: Bessemer billets, $26@26.50; bessemer sheet bars, $26.50@27; openhearth billets, $27@27.50; openhearth sheet bars, $27.50@28, f.o.b. maker's mill, Pittsburgh or Youngstown, with rods at $29@30 for delivery from the same points.

Sheets—For any delivery within the next 60 days, mills have no difficulty in securing premiums of $2 a ton on black and galvanized sheets, while a premium of $1 a ton on blue annealed is also obtainable. Mills have actual specifications to operate them an average of 10 to 12 weeks. Sales for next year have decreased somewhat, the mills which were free sellers being now fairly well filled through first quarter, while others, not so well filled, are refraining from selling on account of uncertainty as to their steel supply. We quote the market as follows:

Black sheets, 28 gage, 2.25@2.35c.; galvanized, 28 gage, 3.40@3.50c.; blue annealed, 10 gage, 1.60@1.65c.; painted corrugated, 2.35@2.45c.; galvanized corrugated, 3.45@3.50c., Pittsburgh.

St. Louis

Oct. 28—The market for pig iron has been very strong during the past week. The demand for finished products has been better than for years. All of the car plants and steel foundries are on full time. Labor, however, on the East Side is very scarce, which is attributed largely to the departure of numbers of Greeks and other people from southern Europe for the war. Southern No. 2 foundry remains at $14, Birmingham, or $17.75, St. Louis. Producers predict a price of $15 before long. Northern iron is bringing around $18.50, St. Louis.

Coke is very scarce, foundry coke from the Connellsville region bringing $6.25@6.50, St. Louis. Byproduct coke is coming into its own and more is being used than ever before.

Iron Ore Trade

Imports and exports of iron and manganese ores in the United States, eight months ended Aug. 31, long tons:

	1911	1912	Changes
Iron ore, imp.....	1,177,896	1,358,881	I. 180,985
Iron ore, exp.....	484,578	729,082	I. 244,504
Manganese, imp....	110,382	153,364	I. 42,982

Imports this year incuded 903,665 tons from Cuba; 243,605 from Sweden; 80,145 from Spain; 75,260 from Newfoundland and Labrador; 46,864 from Canada; 9342 from other countries. Exports are chiefly to Canada.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for eight months ended Aug. 31, are valued as below by the Bureau of Foreign and Domestic Commerce of the Department of Commerce and Labor:

	1911	1912	Changes
Exports	$159,113,290	$190,411,532	I. $31,298,242
Imports	20,224,223	18,509,648	D. 1,714,575
Excess, exp.	$138,889,067	$171,901,884	I. $33,012,817

Increase in exports this year, 19.7%; decrease in imports, 8.5%. The leading articles of iron and steel were, in long tons:

	Exports 1911	Exports 1912	Imports 1911	Imports 1912
Pig iron.....	85,378	172,697	107,999	77,671
Scrap.....	57,596	72,962	13,423	11,373
Billets, blooms, etc.	161,424	199,947	21,366	12,100
Bars.....	95,143	141,627	19,195	16,793
Rails.....	311,732	312,894	523	2,495
Sheets and plates..	219,210	361,854	1,548	2,440
Structural steel....	143,173	192,324	281	1,584
Wire-rods.....	11,096	42,123	11,284	9,635
Wire.....	139,635	167,609	.....	.....
Nails and spikes..	48,727	68,304	.....	.....
Tinplates.....	36,095	60,100	12,662	1,296
Pipe and fittings..	130,147	172,270	.....	.....

Imports of wire not reported in quantities; values were $929,759 in 1911, and $705,700 in 1912. Exports of mining machinery were valued at $4,615,572 in 1911, and $4,930,930 this year.

METAL MARKETS

New York, Oct. 30—The metal markets continue generally strong, but have been rather quiet during the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Sept. 1912..	$ 568,302	$ 4,200,682	Imp. $3,632,380
" 1911..	2,352,861	4,704,096	Imp. 2,351,235
Year 1912..	43,728,274	38,789,793	Exp. 4,938,481
" 1911..	18,263,310	45,177,106	Imp. 26,913,796
Silver			
Sept. 1912..	6,011,221	3,648,883	Exp. 2,362,338
" 1911..	4,940,391	4,161,706	Exp. 778,685
Year 1912..	52,347,946	36,301,752	Exp. 16,046,194
" 1911..	49,527,961	33,696,430	Exp. 15,831,531

Exports from the port of New York, week ended Oct. 26: Gold, $70,100; silver, $820,585, chiefly to London. Imports: Gold, $1,162,288, principally from London; silver, $480,658, largely from Central and South America.

Gold—Prices on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Supplies went chiefly to the Bank of England and to Paris.

Platinum—The market is again a little more active, but prices show no change. Dealers here continue to ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal, up to 10% iridium.

Iridium—Prices are firm and unchanged at $68@70 per oz., New York.

Palladium—There is some demand for this metal, and $72 per oz. is quoted.

Silver—The market has fluctuated between small limits, closes today at 29d. in London. It is expected that the Autumn requirements for the India Mint may give more firmness to the market.

SILVER AND STERLING EXCHANGE

October	24	25	26	28	29	30
New York...	63¼	63	63⅛	63	63¼	62⅞
London.....	29 1/16	29 1/16	29⅛	29 1/16	29 1/16	29
Sterling Ex..	4.8600	4.8570	4.8570	4.8575	4.8575	4.8580

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Oct. 17, as reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£6,950,300	£8,591,500	I. £1,641,200
China.....	989,700	993,500	I. 3,800
Total.....	£7,940,000	£9,585,000	I. £1,645,000

Coined silver in the United States Oct. 1, as estimated by the Treasury Department: Standard dollars, $565,424,367; subsidiary coins, $167,248,119; total, $732,652,486. Of the dollars $495,214,000 are held by the Treasury against silver certificates outstanding.

Copper, Tin, Lead and Zinc

NEW YORK

Oct.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
24	17½ @17¾	17.20 @17.30	50¼	5.00 @5.05	4.85 @4.90	7.35 @7.40	7.20 @7.25
25	17½ @17¾	17.20 @17.30	50¼	5.00 @5.05	4.85 @4.90	7.35 @7.40	7.20 @7.25
26	17½ @17¾	17.20 @17.30	50¼	5.00 @5.05	4.85 @4.90	7.35 @7.40	7.20 @7.25
28	17¼ @17¾	17.15 @17.25	50⅝	5.00 @5.05	4.80 @4.85	7.30 @7.40	7.15 @7.25
29	17½ @17¾	17.15 @17.25	50⅛	5.00 @5.05	4.80 @4.85	7.30 @7.40	7.15 @7.25
0	17¼ @17¾	17.15 @17.25	50⅛	5.00 @5.05	4.80 @4.85	7.30 @7.40	7.15 @7.25

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Oct.	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
24	75⅝	76⅛	81	230	228¼	19¼	27½
25	75⅝	76⅛	81	230	229	19¼	27½
26	....	....	....	.....	.....	....	....
28	75⅝	76⅛	81	231¼	230½	19⅜	27½
29	75¼	75⅞	80⅛	230	229¼	19⅜	27⅜
30	74¾	75⅛	80⅛	229	228¾	19¼	27⅜

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = ± 21¾c.

Copper—The market continues to be extremely quiet, domestic consumers holding aloof and foreign supplying themselves out of European stocks. The larger agencies maintain the old price and make no attempts to effect sales. Other agencies, however, are willing to meet the market and take what they can get. But so far no pressure to make sales has been exerted. The market closes very quiet, with an easier tendency. Lake copper is quoted nominally at 17½@17¾c.; electrolytic in cakes, ingots and wirebars closes at 17.15@17.25c. Casting copper is quoted nominally at

17.05@17.15c. as the average for the week.

The standard market, which, up to Oct. 28, held fairly steady to firm, became weak on Oct. 29 under liquidation and bear sales. A further decline took place during the morning exchange of Oct. 30, after which a slight reaction set in, but the market closes barely steady at £74 15s. for spot and £75 7s. 6d. for three months.

Copper sheets are 23@24c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 19@19¼ base, carload lots at mill.

Copper exports from New York for the week were 6992 long tons. Our special correspondent gives the exports from Baltimore at 594 tons for the week.

Copper production in Russia, for the half year ended June 30, is reported as follows: Urals, 8885; Caucasus, 4623; Siberia, 2056; chemical works and refineries, 580; total, 16,144 long tons. This is an increase of 4709 tons, or 41.2% over the first half of last year.

Tin—The London market presented an unusually steady appearance during the past week, fluctuations there hardly exceeding £1. Reports from abroad continue of a very bullish character and a further large advance in price is being predicted. Notwithstanding all these advices, interests on this side are not willing to accumulate stocks, but were rather anxious to effect sales. Inquiry on the part of consumers was active, and they were able to purchase their supplies at from ⅛ to ¼c. below importation point.

The market closes easy at £229 for spot and £228 15s. for three months in London, and about 50⅛c. here for November tin.

Lead—The market was flooded with offers, emanating from Western smelters and dealers, and the demand, which was fairly good, was taken care of at ever-receding prices. The American Smelting & Refining Co. still maintains its price of 5.10c. for New York delivery, but outside lead, in consequence of the low Western price, is offered much below that figure. The market closes weak at 4.80@4.85c., East St. Louis, and 4.95@5c., New York.

The weakness in the European market has made further progress. While the selling pressure has abated somewhat, the demand has also fallen off, and the market closes dull at £19 5s. for Spanish lead and £19 7s. 6d. for English.

Spelter—While the demand for this metal has remained slight, there was some anxiety displayed by sellers to market their product. In consequence thereof, prices have suffered and the market closes at 7.15@7.25c., f.o.b. St. Louis, and 7.30@7.40c., f.o.b. New York.

Reports from Europe are to the effect that the demand over there has also fallen off somewhat, and that the tone of the market is easier. The close is cabled at £27 7s. 6d. for ordinaries and £27 12s. 6d. for specials.

Base price of zinc sheets is $9 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted 7¼c. per lb., New York.

Other Metals

Aluminum—The market is strong and active, and business seems to have been stimulated by the higher prices. Current quotations for early delivery are 27c. per lb. for No. 1 ingots, New York; while up to 28@29c. per lb. is asked for futures.

Antimony—The market is strong and business has been on a good scale. Offerings by producers are light. Cookson's is quoted at 10½c. per lb. and Hallett's at 9⅞@10¼c.; while 9⅜@9⅝c. is paid for Chinese, Hungarian and other outside brands.

Quicksilver—Business is good and the market is steady, but with no material change in prices. New York quotations are $42@42.25 per flask of 75 lb., with 60c. per lb. asked for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. London price is £8 per flask, with £7 17s. 6d. asked from second hands.

Nickel—Shot, blocks, plaquettes bring 40@45c. per lb., according to quality. Electrolytic nickel is 3c. per lb. higher.

Imports and Exports of Metals

Exports and imports of metals in the United States, eight months ended Aug. 31, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	247,592	119,815	Exp. 127,777
Copper, 1911....	236,787	100,923	Exp. 135,864
Tin, long tons....	371	35,440	Imp. 35,069
Tin, 1911.....	863	32,327	Imp. 31,464
Lead, short tons.	46,126	61,857	Imp. 15,731
Lead, 1911.....	71,366	60,656	Exp. 10,710
Zinc, short tons..	6,442	4,463	Exp. 1,979
Zinc, 1911.....	4,244	1,303	Exp. 2,941
Nickel, lb.....	17,708,424	26,573,202	Imp. 8,864,778
Nickel, 1911....	16,078,387	19,551,900	Imp. 3,473,513
Antimony, lb.....	40,982	11,432,269	Imp. 11,391,287
Antimony, 1911.	160,844	6,982,003	Imp. 6,821,159
Platinum, oz.....	.....	68,187	Imp. 68,187
Platinum, 1911.	95	77,505	Imp. 77,410
Aluminum, lb....	211,086	12,029,888	Imp. 11,818,802
Aluminum, 1911	.....	.....	.....
Ores, etc.			
Zinc in ore, lb...	13,480,634	18,930,781	Imp. 5,450,147
In ore 1911....	14,624,226	22,844,827	Imp. 8,220,601
Zinc oxide, lb...	23,223,275	.....	Exp. 23,223,275
Zinc oxide, '11..	18,105,264	.....	Exp. 18,105,264
Zinc dross, lb....	403,918	.....	Exp. 403,918
Zinc dross, '11..	5,608,110	.....	Exp. 5,608,110
Chrome ore, l.t..	.....	36,646	Imp. 36,646
Chrome ore, '11	5	27,568	Imp. 27,563

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Quantity of zinc ore imported in 1912 was 27,517 tons; exported, 15,279. Imports of aluminum were not reported previous to July 1, 1911. Exports of manufactures of aluminum were valued at $844,681 this year. The metal exports given above, include re-exports of foreign materials.

Zinc and Lead Ore Markets

Platteville, Wis., Oct. 26—The base price paid this week for 60% zinc ore was $56@57. The base price paid for 80% lead ore was $64 per ton.

SHIPMENTS WEEK ENDED OCT. 26

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville.....	871,240	84,600	126,000
Mineral Point.....	819,100	.....	.....
Highland.....	607,100	.....	.....
Galena.....	328,800	.....	.....
Benton.....	309,700	64,100	525,600
Shullsburg.....	224,000	.....	.....
Hazel Green.....	180,000	60,000	.....
Cuba City.....	136,550	.....	57,300
Harker.....	82,020	59,460	.....
Linden.....	58,680	.....	.....
Livingston.....	.....	60,000	.....
Montfort.....	.....	80,000	.....
Total.....	3,617,190	408,160	708,900
Year to date.....	165,408,720	7,071,260	30,041,590

Shipped during week to separating plants, 2,170,700 lb. zinc ore.

Joplin, Mo., Oct. 26—Prices of zinc-sulphide ore are unchanged from last week, $61 high, the base $54@58 per ton of 60% zinc. Zinc silicate sold unchanged on a base of $31@34 per ton of

SHIPMENTS WEEK ENDED OCT. 26

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,173,180	.....	1,118,860	$152,090
Joplin.....	2,447,500	.....	249.120	78,824
Duenweg.....	921,560	.....	37,440	26,963
Alba-Neck....	875,940	.....	.....	25,402
Galena.....	704,090	.....	141,320	24,517
Miami.....	270,730	.....	261,010	15,260
Oronogo.....	514,240	.....	63.750	14,131
Spurgeon	143,860	346,500	25,000	10,896
Laeton.....	255,310	.....	.....	7,404
Granby	180,700	192,590	24,890	6,850
Carl Junction	214,520	.....	.....	6,543
Jackson	178,360	.....	7,060	5,215
Aurora.....	57,580	131,040	.....	3,915
Quapaw.....	129,900	.....	.....	3,377
Springfield...	.....	.....	88,000	2,900
Cave Springs	61,100	.....	21,290	2,380
Carthage	64,210	.....	.....	1,753
Sarcoxie.....	62,000	.....	.....	1,674
Wentworth...	.....	62,620	.....	1,000
Davis, Okla..	33,180	.....	.....	830
Totals.....	11,287,860	732,750	2,037,740	$391,924
10 mos.....	461,957,420	29,362,280	77,733,830	$15,022,115

Blende val., the week, $316,508; 10 mos., $12,344,575
Calamine, the week, 11,297; 10 mos., 463,003
Lead value, the week, 64,119; 10 mos., 2,214,537

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January.....	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February....	40.21	45.75	39.16	43.31	54.46	52.39
March.....	39.85	51.56	38.45	49.25	54.57	54.64
April.....	38.88	52.00	37.47	50.36	56.37	54.18
May.....	38.25	55.30	36.79	53.27	55.21	52.45
June.....	40.50	55.88	38.18	54.38	56.49	55.01
July.....	40.75	58.85	38.36	56.59	58.81	58.83
August.....	42.50	55.13	41.28	53.27	60.74	57.04
September..	42.63	59.75	41.29	57.07	59.33	61.26
October.....	42.38	.....	40.89	.....	54.72	.....
November...	45.40	.....	43.25	.....	57.19	.....
December...	44.13	.....	40.76	.....	62.03	.....
Year.....	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

40% zinc. The average price, all grades zinc, is $54.54. Lead sold on a base of $63@64 per ton of 80% metal contents. The average price, all grades of lead, is $63.90 per ton.

Increased demand the past three weeks strengthened the market toward the close 50c. to $1 per ton on a few cars of zinc ore. Of the reserve stock, about one-half is sold ahead, while the remaining half is held for higher prices. Shipments are running high and the outputting continues heavy.

Chemicals

New York, Oct. 30—Conditions in the general market continue good.

Arsenic—Spot supplies are still in demand and prices are higher, at $5.25@5.50 per 100 lb. Futures are also harder, $5@5.50 per 100 lb. being asked.

Copper Sulphate—Trade is a little quieter, but the market is steady. Prices are unchanged at $5.50 per 100 lb. for carload lots, and $5.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Trade is fair and spot nitrate is steady at 2.55c. per lb. Futures are a little uncertain, 2.57½c. per lb. being asked for November and December and 2.60c. for January-March deliveries. The advance is due to large German speculative holdings.

Imports and Exports—Imports and exports of chemicals and fertilizers, including raw materials for chemical manufacture, in the United States for the eight months ended Aug. 31, were as follows:

	Imports	Exports	Excess
Copper sulph. lb.		5,537,588 E.	5,537,588
Copper sul., '11		6,361,920 E.	6,361,920
Bleach, lb.	48,515,139	400 I.	48,514,739
Bleach, 1911	55,930,658	17,358 I.	55,913,300
Potash salts, lb.	420,694,461	2,435,452 I.	418,259,009
Potash salts, '11	445,807,384	1,976,950 I.	443,830,434
Soda salts, lb.	8,260,089	328,362 I.	7,931,727
Soda salts, 1911	17,875,570	405,681 I.	17,469,889
Acetate lime, lb.		54,191,192 E.	54,191,192
Acetate, 1911		53,486,605 E.	53,486,605
Nit. of soda, tons	322,305	6,060 I.	316,245
Nitrate, 1911	384,359	4,086 I.	380,273
Phosphates, tons		836,803 E.	836,803
Phosphates, '11		832,732 E.	832,730
Sulphur, tons	16,854	28,113 E.	11,259
Sulphur, 1911	14,357	17,888 E.	3,531
Pyrites, tons	590,366	I.	590,366
Pyrites, 1911	662,157	I.	662,157
Magnesite, lb.	156,017,586	1,927,638 I.	154,089,948
Magnesite, 1911	192,416,872	1,538,695 I.	190,877,877
Sul. ammonia, lb.	62,032,342	357,600 I.	61,674,742
Sul. am'nia, '11	111,568,408	I.	111,568,403
Arsenic, lb.	3,593,721	650 I.	3,593,071
Arsenic, 1911	3,256,430	3,000 I.	3,253,430

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 253,000 tons.

Petroleum

The Standard Oil companies have announced that they will stop the sale of fuel oil after Dec. 1. The reason given is the large demand for gasoline for engines and automobiles, which makes it more profitable to refine the oil than to sell it in crude form. This applies chiefly to the West, where Lima and Indiana oil has been sold largely as crude oil for fuel purposes.

The Interstate Commerce Commission has informed pipe lines that they may defer, until Dec. 1, compliance with the order requiring them to file schedules of their rates with the commission, on the ground that they are common carriers. This originally was made effective Nov. 1. The postponement is taken in order to give the Commerce Court time to pass upon the petition of the pipe lines for an injunction. This petition of the pipe lines is to be argued immediately.

Mining Stocks

New York, Oct. 30—On Oct. 24, the early dealings on the Exchange showed some weakness and irregularity, but at the close there was a strong tone and general recovery in prices. The curb was rather dull, mining stocks being irregular in price on light trading.

Oct. 25 the Exchange was still under pressure, but rallied a little toward the close. Steel common was especially weak. The Curb dealings in mining stocks were small, at irregular prices.

Oct. 26 the Exchange continued weak and irregular. Mining stocks on the Curb were more active, especially the coppers, which developed some strength.

Oct. 28 the Exchange was notably firmer, but dealings were not heavy. On the Curb mining stocks were moderately active, but price movements were narrow.

Oct. 29 and 30 the Exchange was fairly active, but rather irregular, chiefly on account of the disturbed foreign markets. Mining stocks on the Curb were also irregular, but generally firm, on a narrow business.

Boston, Oct. 29—Continued weakness characterizes the local metal-share market. In fact, the shares of three copper-mining companies reached the lowest levels of the year the past week. Lake broke $8.62½ to $25.62½, Osceola $12 to $101 and Wolverine $4 to $7. Some others are selling very close to the low price for the year. The market is a pre-election one and displays some natural nervousness.

There has been little important news to affect prices, but there has been more or less liquidation in copper stocks.

Notably weak in today's market was North Butte, which touched $32.62½, a loss of $5.62½ for the week. Granby is off $6 to $59.50. The decision of the directors of this company to continue construction work on the mill of the Hidden Creek, rather than to resume dividend payments has had an unfavorable effect on the stock. Calumet & Arizona is off $6 to $75.25 and U. S. Smelting common $2.87½ to $44.87½. It is not believed that people associated with the latter company will be satisfied with control of the former Dow properties alone in Michigan, but will eventually turn up in control of others, possibly Lake Copper.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

Company	July	August	Sept.
Alaska shipments.	2,224,441	1,242,836	1,726,715
Anaconda	23,000,000	25,250,000	24,500,000
Arizona, Ltd.	3,200,000	3,260,000	3,340,000
Copper Queen	7,708,147	8,040,424	9,103,861
Calumet & Ariz.	4,748,000	4,514,000	4,462,000
Chino	2,945,000	3,437,309	3,372,369
Detroit	2,194,090	1,882,289	1,881,668
East Butte	1,261,304	1,410,500	1,250,000
Mammoth	1,818,738	1,802,590	1,834,937
Mason Valley	1,500,000	.....	.....
Nevada Con	6,084,274	.....	.....
Ohio	617,500	.....	.....
Old Dominion	2,543,763	2,597,896	2,204,000
Ray	2,985,965	2,888,095	2,978,405
Shannon	1,446,000	1,400,000	1,142,000
South Utah	142,555	224,855	225,568
United Verde*	2,500,000	2,500,000	2,750,000
Utah Copper Co.	10,602,000	11,248,992	6,616,887
Lake Superior*	19,500,000	21,000,000	19,250,000
Non-rep. mines*	8,970,000	8,970,000	.....
Total production.	105,991,687	.....	.....
Imports, bars, etc.	25,586,735	23,561,161	.....
Total blister	131,578,422	.....	.....
Imp. in ore & matte	7,748,392	8,544,624	.....
Total American.	139,326,814	.....	.....
Miami†	3,027,710	3,048,750	2,949,150
Brit. Col. Cos.:			
British Col. Copper	1,026,006	941,364	.....
Granby	1,802,753	1,970,388	.....
Mexican Cos.:			
Boleo†	2,386,480	.....	.....
Cananea	4,000,000	4,044,000	3,500,000
Moctezuma	3,094,016	3,229,839	771,844
Other Foreign:			
Cape Cop., S. Africa	.....	.....	.....
Kyshtim, Russia	1,325,000	.....	.....
Spassky, Russia	795,200	902,720	.....
Famatina, Argen.	.....	.....	.....
Tilt Cove, Newf'd.	.....	.....	.....
Exports from:			
Chile	8,960,000	8,512,000	6,048,000
Australia	8,288,000	8,064,000	7,616,000
Arrivals in Europe‡	14,114,240	20,200,320	8,518,720

†Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	U.S. Refin'y Product'n	Deliveries, Domestic	Deliveries for Export
X, 1911	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326
V	126,737,836	72,702,277	69,485,945
VI	122,315,240	66,146,229	61,449,650
VII	137,161,129	71,094,381	60,121,331
VIII	145,628,521	78,722,418	70,485,150
IX	140,089,819	63,460,810	60,264,796
X	.....	.....	.....

	Visible Stocks		
	United States	Europe	Total
XI, 1911	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,387
IV	62,367,557	136,819,200	199,186,757
V	65,066,029	134,176,000	199,242,029
VI	49,615,643	117,801,600	167,417,243
VII	44,335,004	108,186,000	152,521,004
VIII	50,280,421	113,299,200	163,579,621
IX	46,701,374	113,568,000	160,269,374
X	63,065,587	107,408,000	170,473,587
XI	.....	.....	.....

Curb trading has been of fair volume and prices generally weak. Alaska Gold is off to $8.50. Butte Central was the weak feature, breaking to $6.50 on suits to recover pool stock. Incidentally the pool in a block of the stock which expired a short time ago has been renewed.

Assessments

Company	Delinq	Sale	Amt.
Alpha Con., Nev.	Nov. 13	Dec. 4	$0.03
Best & Belcher	Nov. 6	Nov. 25	0.05
Big Elk, Ida.	Oct. 9	Nov. 10	0.001
Black Horse, Ida.	Oct. 18	Nov. 8	0.01½
Buffalo, Ida.	Oct. 28	Nov. 28	0.002½
Bullion, Nev.	Oct. 16	Nov. 6	0.03
Crown Point, Nev.	Nov. 11	Dec. 4	0.10
Eastern Star, Ida.	Oct. 12	Nov. 12	0.002
Exchequer, Nev.	Oct. 30	Nov. 20	0.03
Franklin, Mich.	Oct. 18	.....	2.00
Laclede, Ida.	Nov. 18	Dec. 9	0.003
Holy Terror, Ida.	Oct. 18	Nov. 18	0.00½
Hugo, Ida.	Nov. 9	Dec. 9	0.001
Hypotheek, Ida.	Oct. 14	Nov. 4	0.01
Indiana, Mich.	Oct. 16	.....	1.00
Lucky Calumet, Ida.	.....	Nov. 8	0.005
Mayflower, Ida.	Nov. 27	Dec. 27	0.005
National Copper, Ida.	Nov. 15	Dec. 10	0.01
Oneco, Mich.	Oct. 10	.....	1.00
Ophir, Nev.	Nov. 11	Dec. 9	0.15
Rhode Island, Ida.	Oct. 31	Nov. 30	0.00½
Sunshine, Ida.	Oct. 30	Nov. 30	0.001
Tar Baby, Utah	Nov. 2	Dec. 2	0.002½
Union Con., Nev.	Oct. 15	Nov. 6	0.15
Utah Ideal, Utah	Oct. 9	Nov. 10	0.01
Yellow Jacket, Nev.	Oct. 30	Dec. 3	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28.038
June	53.462	53.043	61.290	24.651	24.486	28.215
July	54.150	52.630	60.654	25.034	24.286	27.919
August	52.912	52.171	61.606	24.428	24.082	28.375
September	53.295	52.440	63.078	24.567	24.209	29.088
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.034	70.294
May	11.989	16.031	12.214	16.245	54.313	72.352
June	12.385	17.234	12.611	17.443	56.365	78.259
July	12.463	17.190	12.720	17.353	56.673	76.636
August	12.405	17.498	12.634	17.644	56.266	78 670
September	12.201	17.508	12.508	17.698	55.253	78.762
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42 529	July	42.400	44.519
February	41 614	42.962	August	43 319	45 857
March	40.157	42.577	September	39.755	49.135
April	42.185	43.923	October	41.185	.....
May	43.115	46.053	November	43.125	.....
June	44.606	45.815	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.597
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	4.194	4.223	4.072	12.984	16 509
June	4.435	4.392	4.292	4.321	13.260	17 588
July	4.499	4.720	4.397	4.603	13.530	18.544
August	4.500	4.569	4.406	4.452	14.260	19.679
September	4.485	5.048	4.356	4.924	14.744	22.292
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25 644
May	5.348	6.679	5.198	6.529	24.375	25.790
June	5.520	6.877	5.370	6.727	24.612	25.763
July	5.695	7.116	5.545	6.966	25.006	26.174
August	5.953	7.028	5.803	6.878	26.801	26.443
September	5.869	7.454	5.719	7.313	27.750	27.048
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	15.14	14.30	13.90	14.72	14.12
June	15.90	15.15	14.06	14.11	14.56	14.22
July	15.90	15.15	14.03	14.38	14.53	14.38
August	15.90	15.43	14.00	14.90	14.47	14.85
September	15.90	16.86	13.57	16.03	14.40	15.63
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14.25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS Oct. 29

Name of Comp.	Bid.
Acacia	.04½
Cripple Cr'k Con.	.01½
C. K. & N.	.17⅞
Doctor Jack Pot	.05⅞
Elkton Con.	.65½
El Paso	5.38
Findlay	.04½
Gold Dollar	.18⅞
Gold Sovereign	.02⅞
Isabella	.18⅛
Jack Pot	.04½
Jennie Sample	.06⅞
Lexington	.007
Moon Anchor	.01
Old Gold	.03½
Mary McKinney	.74½
Pharmacist	.01½
Portland	1.00
Vindicator	.87½
Work	.01

SALT LAKE Oct. 29

Name of Comp.	Bid.
Beck Tunnel	.08
Black Jack	.12½
Cedar Talisman	.01
Colorado Mining	.15
Columbus Con.	.10
Crown Point	.01½
Daly-Judge	5.90
Grand Central	.61
Iron Blossom	1.07½
Little Bell	‡.20
Lower Mammoth	.06½
Mason Valley	11.00
May Day	.16½
Nevada Hills	1.55
New York	.01
Prince Con	1.80
Silver King Coal'n	2.85
Sioux Con.	.03
Uncle Sam	.12
Yankee	.16

TORONTO Oct. 29

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡7.00	Foley O'Brien	‡.15
Hudson Bay	‡63.00	Hollinger	14.50
Temiskaming	.38½	Imperial	.02½
Wettlaufer-Lor.	.25	Pearl Lake	.24
Am. Goldfield	.40	Porcu. Gold	.23
Apex	.01½	Preston E. D.	.03
Crown Chartered	.04½	Rea	.28
Dobie	.20	Standard	‡.01
Dome	19.87	Swastika	.08½
Dome Exten.	.11½	West Dome	.13

SAN FRANCISCO Oct 29

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	.05
Belcher	.27
Best & Belcher	.04
Caledonia	.90
Challenge Con.	.05
Chollar	.03
Confidence	.45
Con. Virginia	.30
Crown Point	.39
Gould & Curry	.02
Hale & Norcross	.14
Mexican	2.60
Occidental	.70
Ophir	.41
Overman	.45
Potosi	.03
Savage	.10
Sierra Nevada	.39
Union Con.	.63
Yellow Jacket	.41

Name of Comp.	Bid
MISC. NEV. & CAL.	
Belmont	9.25
Jim Butler	.63
MacNamara	.21
Midway	.47
Mont.-Tonopah	2.10
North Star	.37
West End Con.	1.65
Atlanta	.19
Booth	.06
C.O.D. Con.	.07
Comb. Frac.	.11
Jumbo Extension	.30
Pitts.-Silver Peak	.85
Silver Pick	.07
St. Ives	‡.30
Tramp Con.	.02
Argonaut	‡2.00
Bunker Hill	‡4.50
Central Eureka	.20
So. Eureka	‡2.00

N. Y. EXCH. Oct. 29

Name of Comp.	Clg.
Amalgamated	83
Am. Agri. Chem.	57
Am.Sm.&Ref.,com	81¾
Am. Sm. & Ref., pf.	108⅛
Am. Sm. Sec., pf. B	85
Anaconda	41⅞
Batopilas Min.	1½
BethlehemSteelpf	75
Chino	45⅛
Federal M. & S., pf.	45⅛
Goldfield Con.	2⅝
GreatNor.,ore.,ctf.	45½
Guggen. Exp.	54¼
Homestake	98½
Inspiration Con.	19¼
Miami Copper	26⅝
Nat'nalLead,com.	64½
National Lead, pf.	109½
Nev. Consol.	21¼
Phelps Dodge	215⅛
Pittsburg Coal, pf.	92
Ray Con.	20⅞
Republic I.&S.com.	31⅛
Republic I & S, pf.	92¾
SlossSheffi'd,com.	54
Sloss Sheffield, pf.	95
Tennessee Copper	41
Utah Copper	61½
U. S. Steel, com.	74¾
U. S. Steel, pf.	114
Va. Car. Chem.	46

BOSTON EXCH. Oct. 29

Name of Comp.	Clg.
Adventure	6½
Ahmeek	325
Algomah	3
Allouez	39
Am. Zinc	30⅜
Ariz. Com., ctfs.	3⅞
Bonanza	.30
Boston & Corbin	6½
Butte & Balak.	3½
Calumet & Ariz.	75¾
Calumet & Hecla	550
Centennial	19
Cliff	3
Copper Range	54
Daly West	3¾
East Butte	14¾
Franklin	10
Granby	59¾
Hancock	23
Hedley Gold	23½
Helvetia	1
Indiana	14¼
Island Cr'k, com.	54
Island Cr'k, pfd.	86½
Isle Royale	31
Keweenaw	2
Lake	28
La Salle	4½
Mass	5⅞
Michigan	1¼
Mohawk	60
New Arcadian	2½
New Idria Quick.	7
North Butte	32¾
North Lake	3
Ojibway	3
Old Dominion	58½
Osceola	103
Quincy	80
Shannon	14
Shattuck-Ariz.	27½
Superior	39
Superior & Bost.	1¾
Tamarack	29
Trinity	4⅛
Tuolumne	2½
U. S. Smelting	44¼
U. S. Smelt'g, pf.	50¼
Utah Apex	1⅛
Utah Con.	11¾
Victoria	2½
Winona	4
Wolverine	71
Wyandot	1¼

N. Y. CURB Oct. 29

Name of Comp.	Clg.
Barnes King	.60
Beaver Con.	.42
Braden Copper	7
B. C. Copper	4⅛
Buffalo Mines	2¼
Caledonia	.40
Con. Ariz. Sm.	9/16
Davis-Daly	2⅛
Diam'field-Daisy	6
Ely Con.	.19
Florence	.77
Giroux	4¾
Gold Hill Con.	1/16
Greene Cananea	9⅞
Greenwater	.05
Internat. S. & R.	‡124
Kerr Lake	2¾
Keystone	2
La Rose	2½
McKinley-Dar-Sa.	1⅛
Min. Co. of A. new	2⅞
Motherlode Gold.	1/16
Nev. Utah M. & S.	‡.01
Nipissing Mines	8¼
Ohio Copper	1¼
Pacific Sm. & M.	¾
Puebla S. & R.	1⅛
South Live Oak	2
South Utah M. & S.	5/16
Standard Oil (Old)	1110
Stand'd Oil of N.J.	399
Stewart	1/16
Tonopah	6/16
Tonopah Ex.	2⅛
Tonopah Merger.	1/32
Tri-Bullion	5/16
Tularosa	1/16
Union Mines	‡.10
United Cop., pfd.	10
Yukon Gold	3/16

BOSTON CURB Oct. 29

Name of Comp.	Last
Alaska Gold M.	8⅞
Bingham Mines	5½
Boston Ely	1
Boswyocolo	.01½
Butte Central	6½
Cactus	.09
Calaveras	2½
Chief Cons	1½
Corbin	.23
Cortez	3
Crown Reserve	3½
First Nat. Cop.	1⅛
Majestic	.40
Mazatan	‡½
Moneta Porc.	‡.04½
Nevada-Douglas	3½
New Baltic	1½
Oneco	2
Raven Copper	.30
Rhode Island Coal	.22
San Antonio	‡3
Smokey Dev.	2½
S. W. Miami	5½
South Lake	6½
Trethewey	‡.30
United Verde Ext.	.52

LONDON Oct. 30

Name of Com.	Clg.
Camp Bird	£1 5s 0d
Dolores	1 10 0
El Oro	0 15 6
Esperanza	2 0 6
Mexico Mines	6 15 0
Oroville	0 5 0
Stratton'sInd.	0 3 1½
Tomboy	1 5 9

‡Last quotation.